

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

(NASA-CR-170181) COMPUTER SIMULATOR FOR A
MOBILE TELEPHONE SYSTEM Progress Report, 21
Apr. 1982 - 25 Jan. 1983 (City Coll. of the
City Univ. of New York.) 97 p HC A05/MF A01

N83-22493

CSCL 17B G3/32 03296

Unclas

COMPUTER SIMULATOR FOR A MOBILE TELEPHONE SYSTEM

NASA-LEWIS Research Center

Cleveland Ohio

April 21, 1982 - January 25, 1983

NASA Grant: NAG 3-277

Donald L. Schilling

Professor of Electrical Engineering

Principal Investigator

Chaim Ziegler

Assoc. Prof. of Computer Science

Co-Principal Investigator

COMMUNICATIONS SYSTEMS LABORATORY
DEPARTMENT OF ELECTRICAL ENGINEERING



THE CITY COLLEGE OF
THE CITY UNIVERSITY of NEW YORK

ORIGINAL PAGE IS
OF POOR QUALITY

COMPUTER SIMULATOR FOR A MOBILE TELEPHONE SYSTEM

NASA-LEWIS Research Center

Cleveland Ohio

April 21, 1982 - January 25, 1983

NASA Grant: NAG 3-277

Donald L. Schilling

Professor of Electrical Engineering

Principal Investigator

Chaim Ziegler

Assoc. Prof. of Computer Science

Co-Principal Investigator

COMMUNICATIONS SYSTEMS LABORATORY
DEPARTMENT OF ELECTRICAL ENGINEERING



ORIGINAL PAGE IS
OF POOR QUALITY

Table of Contents

	Page -----
Introduction	1
The Present Simulator	2
Processing Voice Via The Simulator	26
User's Guide	36
Sample Runs	52
Results	54
Proposed Research for the Forthcoming Year	65

1. Introduction

This project is the result of a joint effort between the Department of Electrical Engineering at the City College, CUNY; and the Department of Computer & Information Science at the Brooklyn College, CUNY.

The goal of this project is to develop a software simulator to help NASA in the design of the LMSS. The simulator will be used to study the characteristics and implementation requirements of the LMSS's configuration with specifications as outlined by NASA.

This report represents progress made in implementing the simulator during the period 4/21/82 - 1/25/83.

ORIGINAL PAGE IS
OF POOR QUALITY

2. The Present Simulator -----

The basic components of the present simulator were described previously in the first report (NASA Grant: NAG 3-119). However, previously, not all the components of the system were operational and only scenario 1 was implemented.

The current simulation now includes all the components, such as the interference sources, the S-band channels, the noise sources, the gateways, a revised master controller for the simulator, as well as other components which were recently completed.

The present simulator is now capable of executing all 5 scenarios, which are described below .

2.1 The Communication Scenarios -----

Through the use of the five scenarios, it is possible to study all the different possible combinations of types and modes of calls. The five scenarios are described below:

(1). Single Hop System:

For those calls which require the communication between two mobile units, without going through a gateway, we group them together and form scenario 1. In this scenario, a mobile will generate a call, for which the call will go up to the satellite, and be transponded down directly to the destination mobile. This can be seen in

ORIGINAL PAGE IS
OF POOR QUALITY

figure 2.1.

(2). Double Hop, Single Gateway System:

For those calls which require communication between two mobile units by going through a gateway, we group them together and form scenario 2. In this scenario, a mobile will initiate a call, which will be transponded by the satellite to a gateway. After processing by the gateway, the call is once again transponded by the satellite to the destination mobile. This can be seen in figure 2.2.

(3). Double Hop, Double Gateway System:

For those calls which have to go through two gateways, we form scenario 3. In this scenario a mobile will generate a call, which is transponded to a gateway. The gateway forwards the call to the master control station. The master control station then routes the call to the destination gateway. Then the call is once again transponded by the satellite to the destination mobile. This can be seen in figure 2.3.

(4). Mobile-to-Wireline System

For any call that was initiated by a mobile and was desired to go through a fixed phone or to a mobile serviced by the cellular system, we have scenario 4. In this scenario, the call is initiated by the mobile and transponded by the satellite to a gateway. Then, the gateway forwards the call into the wireline network. This can be seen in figure 2.4.

ORIGINAL FILED IN
OF POOR QUALITY

(5). Wireline-to-Mobile System:

If a call is initiated by a fixed phone or mobile in a cellular system to a mobile in the LMSS, we resort to scenario 5. In this scenario a call is received from the wireline telephone network into a gateway. The call is then transponded by the satellite to the destination mobile. This can be seen in figure 2.5.

ORIGINAL PAGE IS
OF POOR QUALITY

2.2 Output Facilities

Also new in the present simulator is the revised version of the Master Controller (see 4.1.2, first report). In the present simulator it is possible to go through a range of values for any one of the components in the scenario. It is possible to consider a range of values for up to 14 different components simultaneously. Previously, if a type 2 measurement was chosen, the simulator would display a two column table of the input vs output SNR values, for a given set of system parameters. With the present simulator it is possible in a type 2 measurement for the simulator to display up to 15 columns (15th column is output signal to noise ratio), one for each range of component values. In the present simulator, it is also possible to get plots of the input vs. output SNR values for any range of values of the other components (see section 5, "Sample Runs"). The looping or ranging feature mentioned above can also be used in a type 1 measurement, were the input signal, output signal (no disturbances present), and output signal (with all specified disturbances) are displayed in a table. It is now possible to consider a type 1 measurement over a range of values (up to 14 possible ranges of parameters). Once again, a plotting facility is available for every type 1 measurement table displayed (see section 5, "Sample Runs").

The revised master controller function has the following algorithm:

/SIMULATION MASTER CONTROLLER FUNCTION/:

<initialize simulation master controller function>

DO <range of Specular-to Multipath Power Ratio--UHF Uplink >

<range of Specular-to-Multipath Power Ratio--S-Band Downlink>

<range of Specular-to-Multipath Power Ratio--S-Band Uplink>

<range of Specular-to-Multipath Power Ratio--UHF Downlink>

<range of carr.-to-interf. power ratio--UHF Uplink Interference>

<range of phase values--UHF Uplink Interference >

<range of carr.-to-interf. power ratio--S-Band Downlink Interf>

<range of phase values--S-Band Downlink Interference>

<range of carr.-to-interf. power ratio--S-Band Uplink Interf.>

<range of phase values--S-Band Uplink Interf.>

<range of carr.-to-interf. power ratio--UHF Downlink Interf>

<range of phase values--UHF Downlink Interf.>

<RANGE OF SNR >

<calculate SNR>

<calculate standard deviation for white noise>

<perform simulation reset>

<set flag for mobile transmitter>

<PERFORM a simulation run>

<perform master controller instrumentation package>

END <signal to noise ratio>

END /simulation master controller function/

2.3 System Structure

The present modular structure can be seen in the flowchart of figure 2.6, with its subroutines defined in table 2.7.

ORIGINAL PAGE IS
OF POOR QUALITY

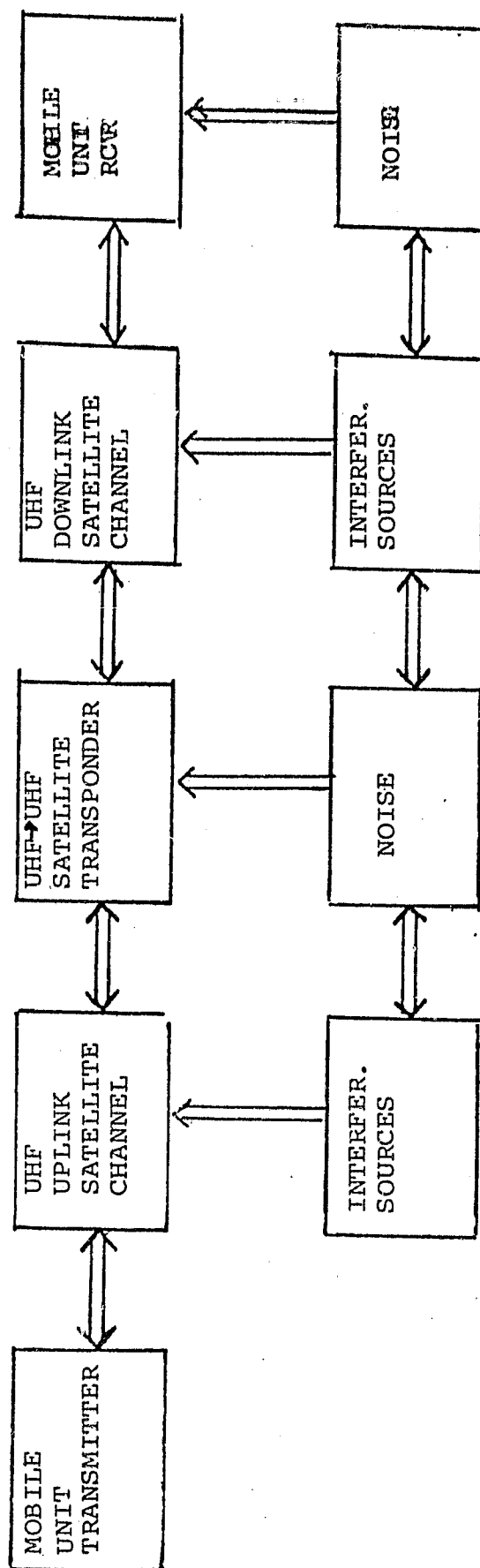
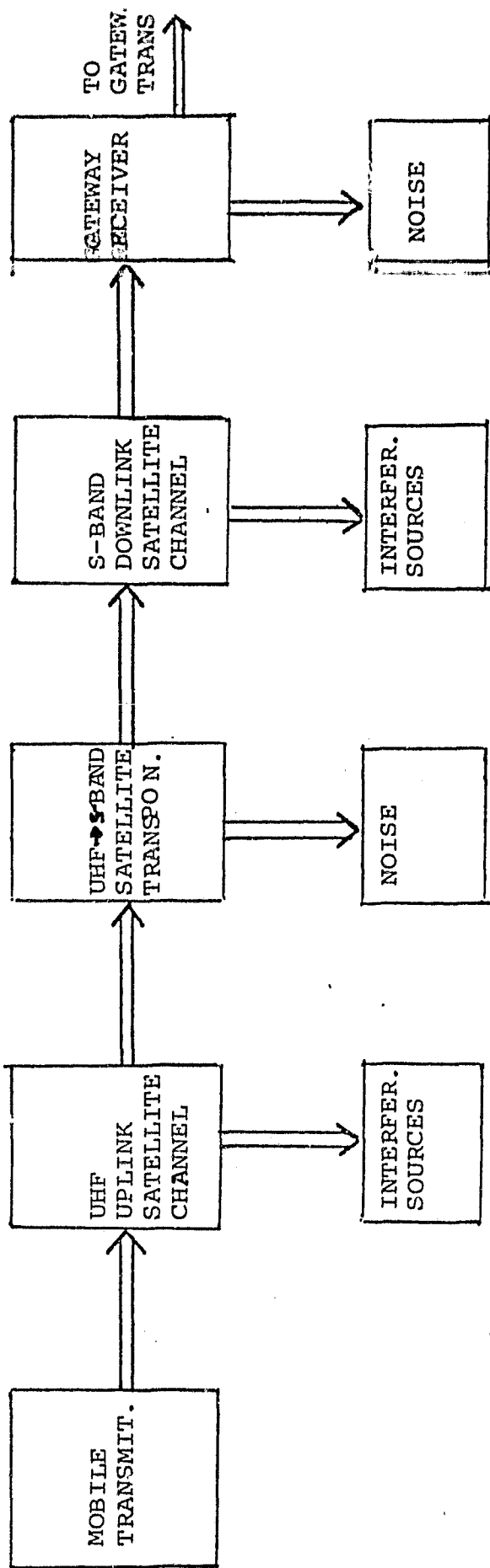


Figure 2.1 : Single Hop Gateway System



ORIGINAL PAGE IS
OF POOR QUALITY.

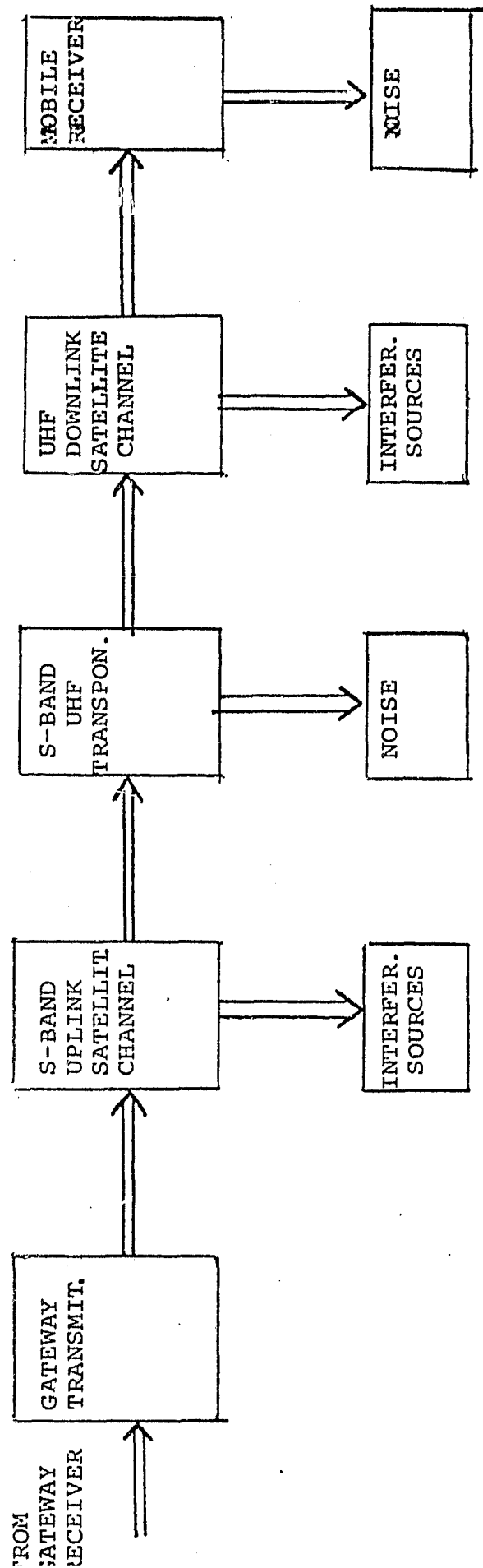


Figure 2.2 : Double Hop Single Gateway

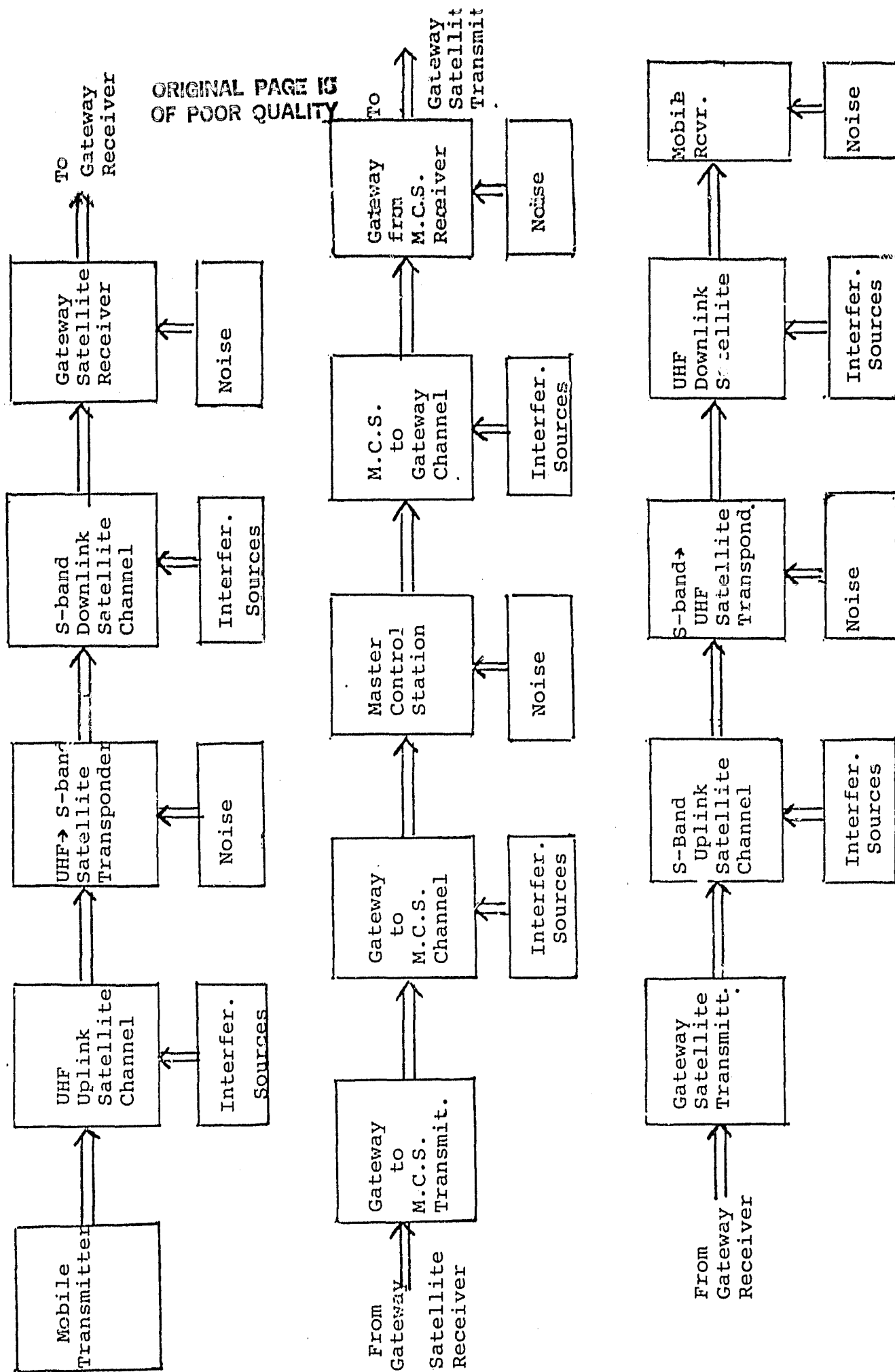
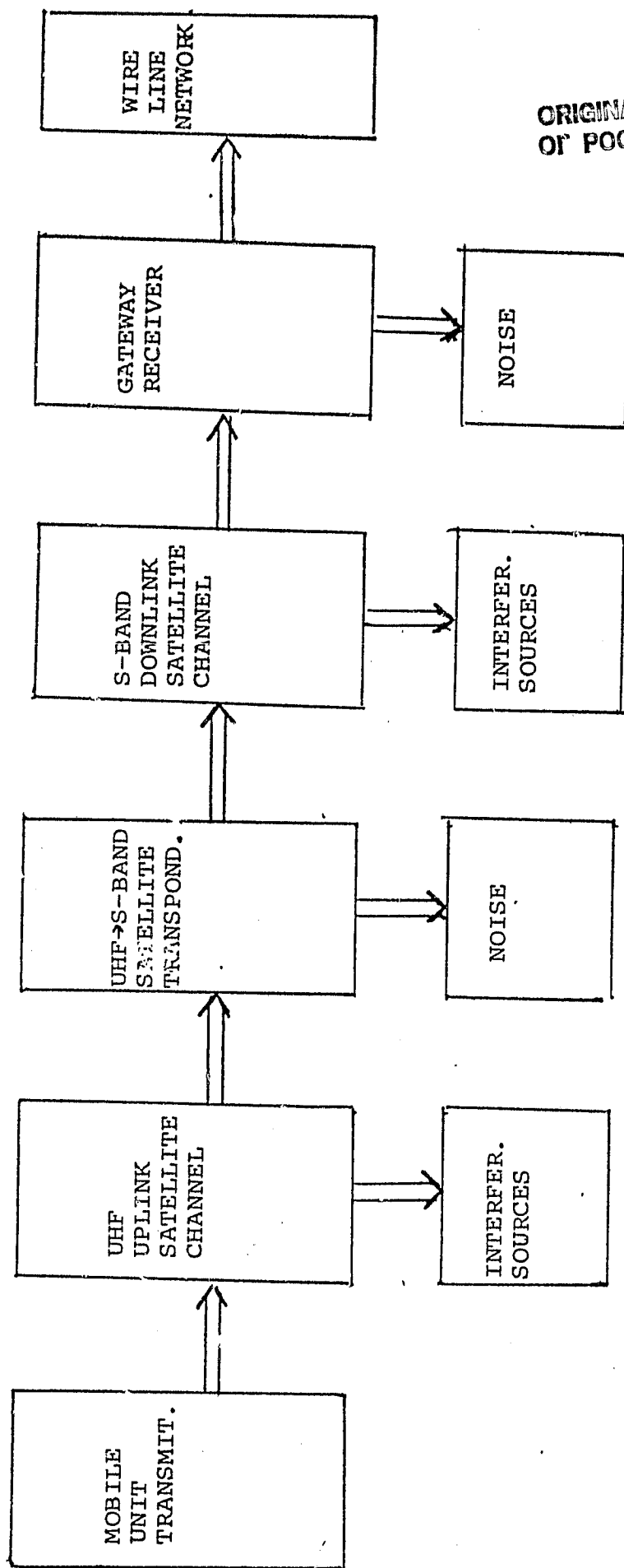


Figure 2.3 : Double Hop Double Gateway



ORIGINAL PAGE IS
OF POOR QUALITY

Figure 2.4 : Mobile to Wireline System

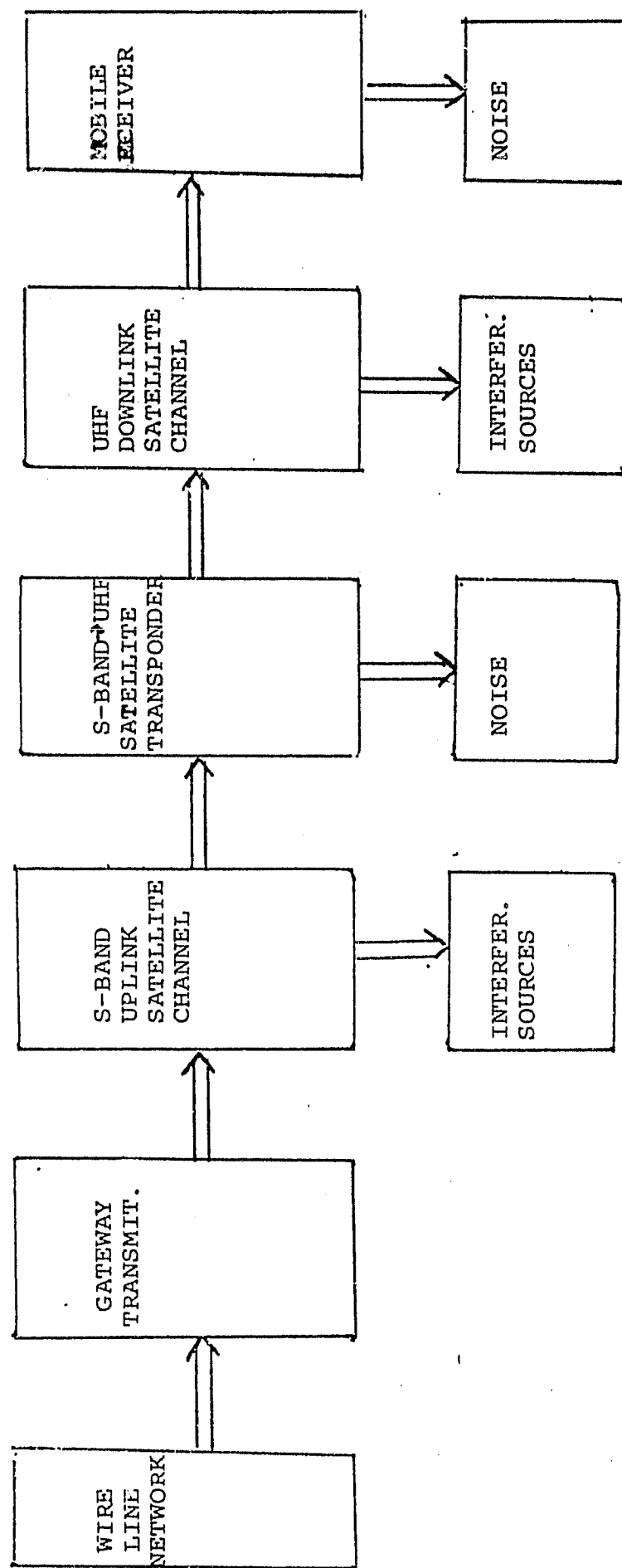


Figure 2.5 : Wireline to Mobile System

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

```
*****  
*****  
***** LMSS SIMULATOR *****  
*****  
  
FLOW CHART OF LMSS SIMULATOR
```

MATN

SELECT

```

SETUP-----> (1)

```

SETCON

MASCON

SETMC

RESET----->

[illegible]

INSTRM

ENDS TM

SCENAR-->

UPCON

RSTUPK-->GAUS

RSTD LK-->GAUS

RESULT

BTGSRC

^ - SCEN1 --> (2)

^ SCEN2-->(3)

SELECT ONE----->^ SCEN3-->(4)

^ SCEN4-->(5)

^ - SCEN 5 - - > (6)

ORIGINAL PAGE 13
OF POOR QUALITY

SET-UP ROUTINES FOR EACH
SCENARIO

(1)

^
^
^
^

SCENARIO 1

SETMSX-----	->SETSSG	
SETIS1	SETMOD	
SETUSC----	->SETCFG	SETSPX---->SETCOM
SETNG1	SETFAD	SETNL SETEMP
SETUUT		SETFLR SETDEL
SETIS6		SETPDL
SETSUC----	->SETCFG	
SETNG6	SETFAD	
SETMSR-----	->SETRSP	
	SETFMD	
	SETRCF	
	SETSPR----	->SETDPH
		SETEXP

SCENARIO 2

SETMSX-----	->SETSSG	
SETIS1	SETMOD	
SETUSC----	->SETCFG	SETSPX---->SETCOM
SETNG1	SETFAD	SETNL SETEMP
SETUBT		SETFLR SETDEL
SETIS2		SETPDL
SETSBC		
SETNG2		
SETGSR		
SETGAT		
SETGSX		
SETIS5		
SETBSC		
SETSUT		
SETIS6		
SETSUC----	->SETCFG	
SETNG6	SETFAD	

ORIGINAL PAGE 13
OF POOR QUALITY.

SETMSR----->SETRSP
 SETFMD
 SETRCF
 SETSPR--->SETDPH
 SETEXP

SCENARIO 3

SETMSX----->SETSSG
SETIS1 SETMOD
SETUSC----->SETCFG
SETNG1 SETFAD
SETUBT
SETIS2
SETSBC
SETNG2
SETGSR
SETGAT
SETGCX
SETIS3
SETGCC
SETNG3
SETMCS
SETIS4
SETCGC
SETNG4
SETGCR
SETGSX
SETIS5
SETBSC
SETNG5
SETSUT
SETIS6
SETSUC----->SETCFG
SETNG6 SETFAD
SETMSR----->SETRSP
 SETFMD
 SETRCF
 SETSPR--->SETDPH
 SETEXP

ORIGINAL PAGE IS
OF POOR QUALITY

SCENARIO 4

```
SETMSX----->SETSSG
SETIS1
SETISC----->SETCFG
SETNG1      SETFAD
SETUBT
SETIS2
SETSBC
SETNG2
SETGSR
SETGAT
SETWNR
```

SCENARIO 5

```
SETWNX
SETGAT
SETGSX
SETIS5
SETBSC
SETNG5
SETSUT
SETIS6
SETSUC----->SETCFG
SETNG6      SETFAD
SETMSR----->SETRSP
              SETFMD
              SETRCF
              SETSPR----->SETPDH
                          SETEXP
```


ORIGINAL POSITION
OF POOR QUALITY

*
** SCENARIO 1 **
*

(2)

MSXMTR-----SIGSRC
INTFS1
UPMTSC-----FADE
NOISE1
SATLT
INTFS6
DNSTMC-----GAUS
NOISE6-----DOPFLT
MSRCVR-----
INSTRS
FADE-----MPCOEFF-----GAUS
FADE-----DOPFLT
MPCOEFF-----GAUS
DOPFLT
GAUSS
GAUSS
RSPDIV-----SLPFLT1
FMDemo-----FMDCRT
SLPRRC-----DEMPH1
EXPAND

ORIGINAL PAGE 11
OF POOR QUALITY

* *
** SCENARIO 2 **
* *

(3)

```

MSXMTR----->SIGSRC
INTFS1          SIPRXT----->COMPRS
UPMTSC--->FADE    MODSIG--->  PEMPHA
NOISE1      MPCOEFF--->GAUS    NONLIN  ^  DEVLIM
SATLT          DOPFLT          FLPTR   ^  PDEVLI
INTFS2
DNSTGC
NOISE2
GSRCVR          PHASE
GATE            QUAD
GSXMTR
INTFS5
UPGTSG
NOISE5
SATLT
INTFS6
DNSTMC----->FADE----->
NOISE6----->GAUSS    FADE----->
MSRCVR----->    GAUSS          ^
INSTRS          ^      MPCOEFF    ^
                ^      GAUS      ^
                ^      DOPFLT    ^
                ^      MPCOEFF    ^
                ^      GAUS      ^
                ^      DOPFLT    ^

```


ORIGINAL PAGE IS
OF POOR QUALITY

HP800H
INTFS3
GTCC
NOISE3
MSTRCS
INTFS4
CTGC
NOISE4
GCRCVR
GATE
GSXMTR
INTFS5
UPGTSC
NOISE5
SATLT
INTFS6

```

DNSTMC----->FADE----->
NOISE6----->GAUSS      FADE---> ^
MSRCVR----->      GAUSS      ^      MPCOEFF
      ^
      ^
      ^      MPCOEFF      GAUS
      ^      DOPFLT
RSPDTV----->
FMDEMO----->      ^      GAUS
SIPRRC-->      ^      DOPFLT
      ^      LPFLT1
      ^      LPFLT1
      ^      CHOICE
      ^
      ^      FMDORI
      ^      RCFLTR---->LPFLT
      ^
      DEMPHA--->LPFLT2
      EXPAND

```


ORIGINAL PARTS
OF POOR QUALITY


```

*****
*
** SCENARIO 4 **
*
*****

```

(5)

⌋
⌋
⌋
⌋

```
MSXMTTR----->SIGSRC  
INTFS1                      SI PRXT----->  
UPMTSC----->FADE          MODSIG--> ^  
NOISE1                     ^        NONLTM    ^ ^  
SATLT                      MPCOEFF           FLPTR    ^ ^  
INTFS2                     ^                ^      ^ ^  
DNSTGC                    GAUS              ^      COMPRES  
NOISE2                    DOPFLT            ^      PEMPHA  
GSRCVR                   ^                  ^      DEVLTM  
GATE                     ^                  ^      PDEVLT  
WNCVR                   ^                  ^  
INSTRS                   ^                  ^  
  
                                PHASE  
                                QUAD
```

* * * * *
 * * * * *

CRITICAL
OF POOR QUALITY

*
** SCENARIO 5 **
*

(5)

^
^
^
^

WNMXTR
GATE
GSXMTR
INTFS5
UPGTSC
NOISE5
SATLT
INTFS6
DNSTMC-----
NOISE6----->GAUSS
MSRCVR----->
INSTRS

RSPDIV----->
FMDM0----->
SIPRR0-->

^
^
^
^
^
^
^
^
^
^

FMDRT
RCFLTR---->LPFLT

DEMPHA---->LPFLT?
EXPAND

>FADE-->

FADE

^ MPCOEFF

^ GAUS
^ DOPFLT

^ MPCOFF

^ GAUS
^ DOPFLT

^ LPFLT1
^ LPFLT1
^ CHOICE

ORIGINAL PAGE IS
OF POOR QUALITY

LMSS SIMULATOR

Subprocedures Dictionary:

CHOICE space diversity receiver controller
CTGC master control station to gateway channel
DNSTGC S-band downlink satellite channel
DNSTMC UHF downlink satellite channel
ENDSIM test if it is end of simulation
FLTR quadrature components filtered
FMDCRT FM discriminator
FMDEMO FM demodulator
GATE gateway
GAUSS gaussian generator
GCRCVR gateway from master control station rcvr
GCXMTR gateway to master control station xmtr
GSRCVR gateway from satellite rcvr
GSXMTR gateway to satellite xmtr
GTCC gateway to master control station channel
INSTRM update simulation master-control report
INSTRS update simulation sub-control report
INTFS1 interference sources 1
INTFS2 interference sources 2
INTFS3 interference sources 3
INTFS4 interference sources 4
INTFS5 interference sources 5
INTFS6 interference sources 6
MASCON simulation master control function
MODSIG modulation of the input sample
MSRCVR mobile from satellite rcvr
MSTRCS master control station
MSXMTR mobile to satellite xmtr
NOISE1 noise generator 1
NOISE2 noise generator 2
NOISE3 noise generator 3
NOISE4 noise generator 4
NOISE5 noise generator 5
NOISE6 noise generator 6
NONLIN nonlinearity routine
PHASE calculation of the phase angle
QUAD claculation of the quadrature components
RANDOM random number generator

OF POOR QUALITY

RRRORT report generator
RESET (re)initialization for a simulation run
RSPDIV space diversity receiver
SATLT the satellite
SCENAR scenario execution selection
SCEN1 scenario 1
SCEN2 scenario 2
SCEN3 scenario 3
SCEN4 scenario 4
SCEN5 scenario 5
SETSET selection of call to be simulated
SETBSC initialize S-band uplink satellite channel
SETCGC initialize master control station to gateway channel
SETFLR initialization of the filter
SETCON initialize the simulation control function
SETFMD initialization of FMDEMO routine
SETGAT initialize gateway
SETGCC initialize gateway to master control station channel
SETGCR initialize gateway from master control station rcvr
SETGCX initialize gateway to master control station xmtr
SETGSR initialize gateway from satellite rcvr
SETGSX initialize gateway to satellite xmtr
SETIS1 initialize interference sources 1
SETIS2 initialize interference sources 2
SETIS3 initialize interference sources 3
SETIS4 initialize interference sources 4
SETIS5 initialize interference sources 5
SETIS6 initialize interference sources 6
SETMC initialize simulation master control function
SETMCS initialize master control station
SETMOD initialization of modulator
SETMSR initialize mobile from satellite rcvr
SETMSX initialize mobile to satellite xmtr
SETNG1 initialize noise generator 1
SETNG2 initialize noise generator 2
SETNG3 initialize noise generator 3
SETNG4 initialize noise generator 4
SETNG5 initialize noise generator 5
SETNG6 initialize noise generator 6
SETNL initialization of nonlinearity
SETRCF initialization of RCFLTR routine
SETRSP initialization of RSPDIV routine
SETSBC initialize S-band downlink satellite channel
SETSSG initialization of the signal generator
SETSUC initialize UHF downlink satellite channel
SETSUT initialize S-band to UHF satellite transponder
SETUBT initialize UHF to S-band satellite transponder

ORIGINAL PAGE IS
OF POOR QUALITY

SETUP initialization of simulation run
SETUHC initialize UHF uplink satellite channel
SETUOT initialize UHF to UHF satellite transponder
SIGSRC sample generator
SETWNR initialize wireline network rcvr
SETWNX initialize wireline network xmtr
SUBCON simulation sub-control function
UPCON update the simulation control function
UPGTSC S-band uplink satellite channel
UPMTSC UHF uplink satellite channel
WNRCLR wireline network rcvr
WNXMTR wireline network xmtr

ORIGINAL PAGE IS
OF POOR QUALITY

3. Processing Voice Via The Simulation

One of the systems greatest present attributes is its ability to process voice. The present simulator can be utilized to listen to any of the following effects on voice (via each of the five scenarios):

- (a). Listen to the effects of noise.
- (b). Listen to the effects of interference.
- (c). Listen to the effects of modulation.
- (d). Listen to the effects of the fading channel.
- (e). Listen to the effects of filtering on the voice.
- (f). Listen to the effects of the space diversity receiver.
- (g). Listen to the effects of the satellite nonlinearity.
- (h). Listen to the effects of varying sampling rates.
- (i). All combinations of the above.

An analysis of a number of the above tests are included within the report (see section 6.2).

A basic model of how to use the simulation to process voice is shown in figure 3.1. In this model, an analog to digital converter samples voice at a rate of at least 8 kilohertz (minimum sampling rate for voice bandlimited to 4000 Hz.), producing 12 bit samples. In the second stage, these 12 bit samples are converted into 16 bit integer format (IBM format). These 16 bit integers are then read by the LMSS simulator. (see section users manual

ORIGINAL PAGE IS
OF POOR QUALITY

for simulator voice setup). The output of the LMSS simulator is then converted from 32 bit floating point form (IBM format) back into a 12 bit integer format by the fourth stage. In the fifth stage, a digital to analog converter with the proper hardware connected, converts the samples into voice. In between each of the above stages, any type of storage device could have been used for intermediate storage.

The system outlined above is general, and actual implementation depends on the particular intermediate systems involved (stages 1,2,4,and 5).

In figure 3.2 we have a detailed block diagram of the specific algorithm we used in implementing what was shown in figure 3.1.

The first stage consisted of a 12 bit analog to digital converter interfaced into a Hewlett Packard 1000 (HP 1000) computer system. This system sampled the voice (bandlimited to 4000 Hz) with a sampling rate of 8 Khz, and stored it on tape with a "WRITT" format (This is an HP utility which stores data onto a tape in an ultra-condensed coded format, which can only be read by another HP system). We had to store it in this form because the system we used didn't have enough storage facility to do it any other way. In the next stage, we used another HP 1000, with much greater storage facility to convert the WRITT format tape into straight ASCII data. For error control and checking purposes, data was stored in the format of an integer (16 bit integer, represented by 4 characters) followed by a space.

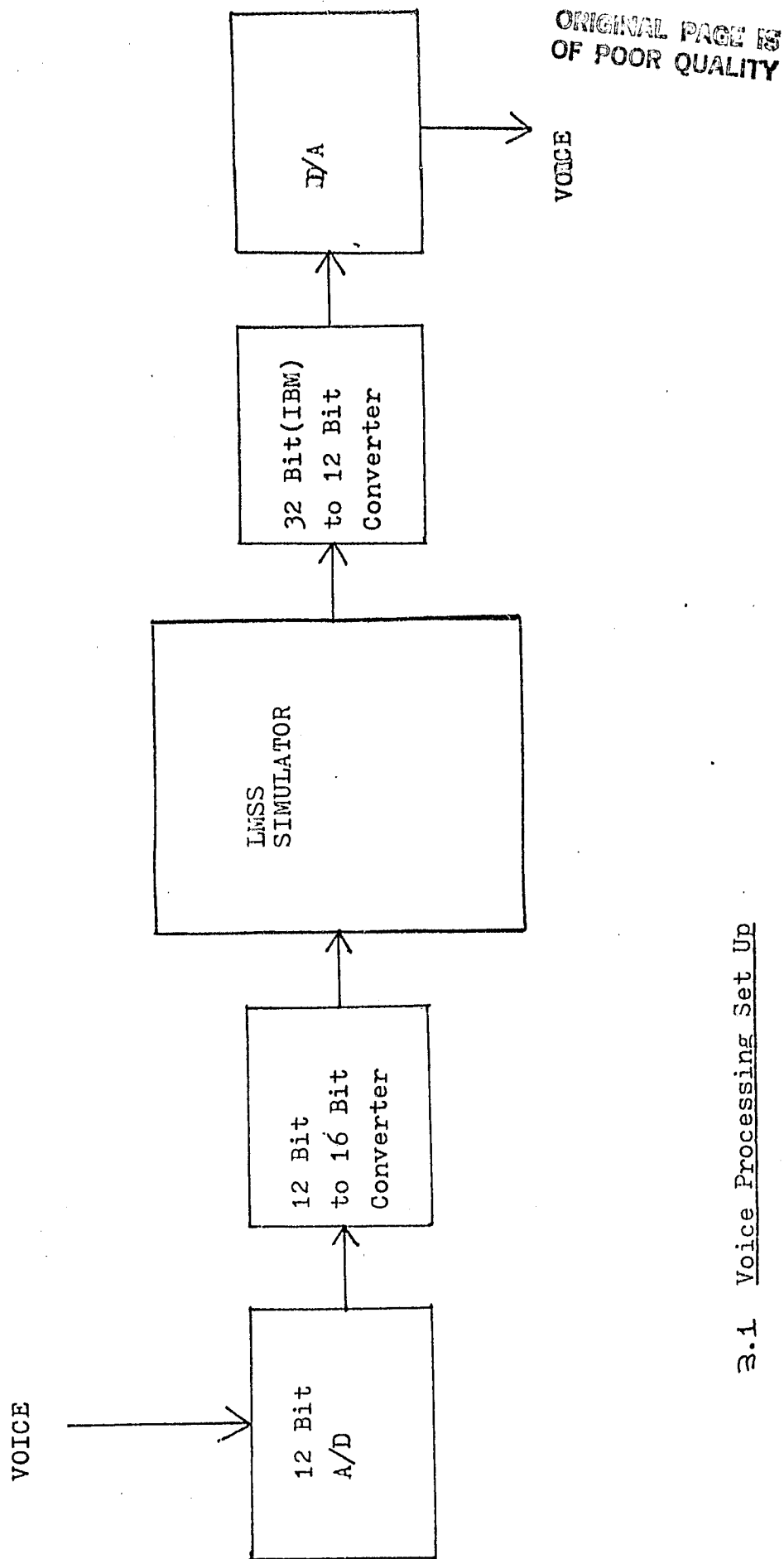
This tape was now to be mounted on the IBM machine. We used the program shown in figure 3.3 to convert from ASCII into EBCDIC

ORIGINAL PAGE IS
OF POOR QUALITY

(IBM) format. We stored the data on a disc. We then used the LMSS simulator to process the voice samples.

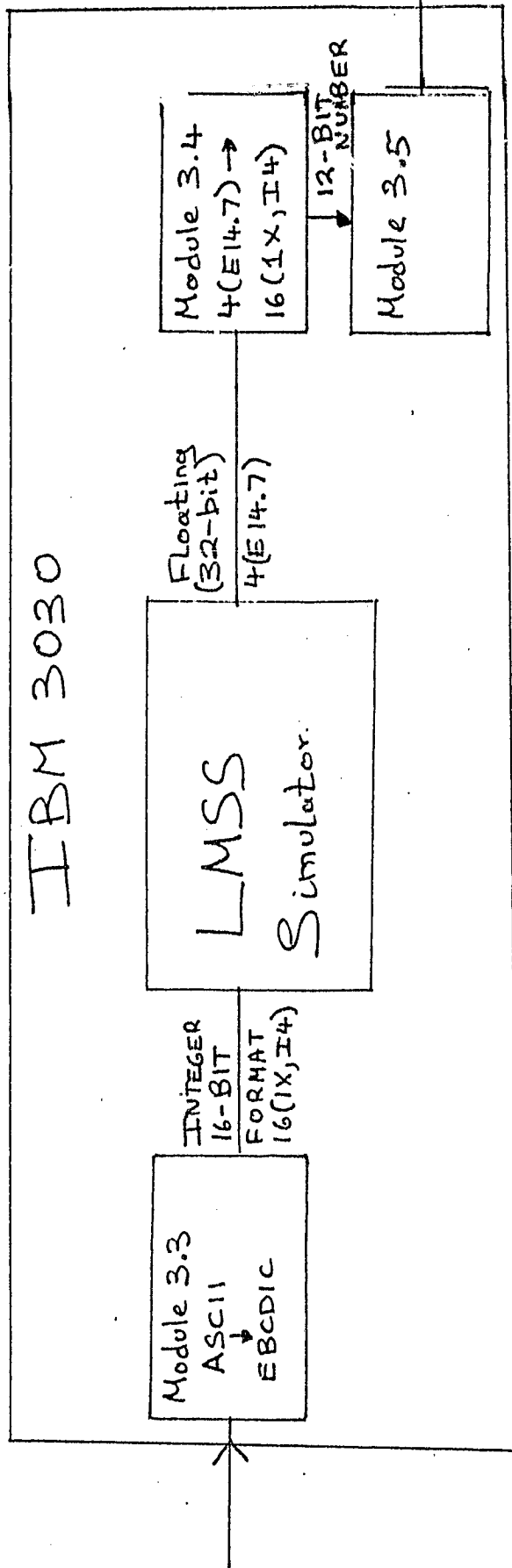
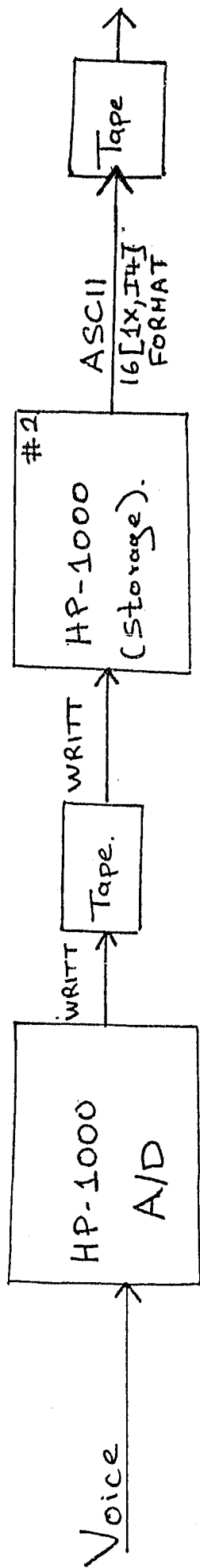
The LMSS simulator has the facility to read in integers (16-bit) in the format mentioned above. The simulator then interpolates between these samples if specified by the user, and then processes them. The output data set is a stream of 32-bit (IBM format) floating point numbers. Module 3.4 (see figure 3.4) is then used to convert this 32-bit data stream into a 16 bit integer data stream (format 16(1x,I4)), with sample values normalized to plus or minus 2047 (12-bit number). Module 3.5 (see figure 3.5) is then used to convert the data from EBCDIC to ASCII format, and stores it on tape. The tape is then read in by module 3.6 (see figure 3.6) using the HP-1000. This module converts data into the format needed by the digital to analog converter. Then finally the D/A converts the samples back to voice.

All the above steps were needed because of code conversions between machines as well as numerical format (the IBM is a 32-bit machine while the HP-1000 is a 16-bit machine). Ideally, one would use the setup of figure 3.1 if the proper equipment is attainable.



3.1 Voice Processing Set Up

IBM 3030 SIMULATOR AND SOFTWARE RUNNING ON VOICE TAPES



ORIGINAL PAGE IS
OF POOR QUALITY

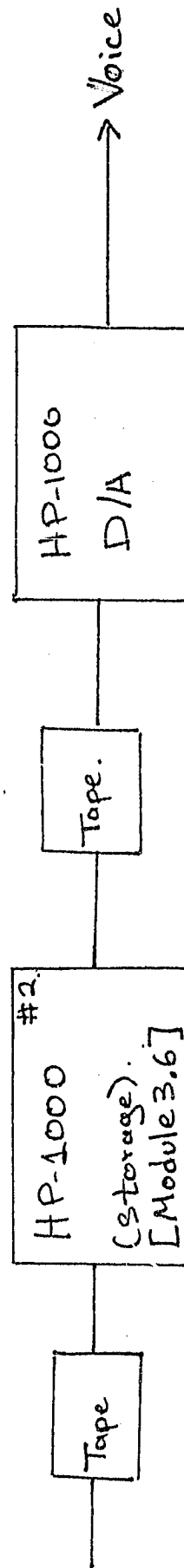


Figure 3.3

ORIGINAL PAGE IS
OF POOR QUALITY

1. This program reads a tape in ASCII format, and converts it to a
2. file in EBCDIC format (File: TAPRD)
3.

4.
5.
6. // JOB
7. //STEP1 EXEC PGM=PRESS
8. //SYSPRINT DD SYSOUT=A
9. //SYSIN DD DUMMY
10. //SYSOUT1 DD DSN=ONE,DISP=(OLD-PASS),LABEL=(1,NL),VOL=SER=CCT260,
11. // UNIT=TAPE,DCB=(1 RECF=80,BLKSIZE=80,RECFM=FB,DE-N=3,OPTCD=Q)
12. //SYSOUT2 DD DSN=MYL.CC.BHC.TAPRD,UNIT=3330,DISP=(,CATLG),
13. // VOL=SER=SCROOP,DCB=(1 RECF=6200,BLKSIZE=6200,RECFM=U,DSORG=PS),
14. // SPACE=(TRK,(20,5),RLSE)
15. //
16. //

Figure 3.4

ORIGINAL PAGE IS
OF POOR QUALITY

THIS PROGRAM READS A FILE OF 32 BIT Floating Point Numbers
in Format (E14.7) per record, and converts them into a file of 12
bit numbers (integers), for use in the D/A system.

```

1.
2.
3.
4.
5.
6.
7. // JOB TIME=4,REGION=400K
8. // *MAIN LINES=50
9. // EXEC FORTGCC
10. // FORT.SYSIN DD *
11. C *****
12.     REAL MAX
13.     DIMENSION X(32768),IX(32768)
14.     MAX=0
15.     READ(1,100,END=200) (X(J),J=1,32768)
16. 100    FORMAT(4(E14.7))
17.     DO 55 J=1,32768
18.         IF (ABS(X(J)).GT.MAX) MAX=ABS(X(J))
19.     55    CONTINUE
20.     PRINT 70,MAX
21.     70    FORMAT(' ',MAX=' ',E14.7)
22.     DO 66 J=1,32768
23.         X(J)=X(J)/MAX
24.         X(J)=X(J)*2046.
25.         X(J)=X(J)+2047.
26.         X(J)=X(J)+.5
27.         IX(J)=X(J)
28.     66    CONTINUE
29.     WRITE(2,333) (IX(J),J=1,32768)
30.     333    FORMAT(16(1X,I4))
31.     200    CONTINUE
32.     STOP
33.     END
34. //GO.FTO1FO01 DD DSN=WYL.CC.BHC.R51B,DISP=SHR
35. //GO.FTO2FO01 DD DSN=WYL.CC.PUB.X51B,UNIT=3330,
36. // DISP=(NEW,CATLG,CATLG),SPACE=(TRK,(14,5),RLSE),
37. //     VOL=SER=SCRO03,
38. //     DCB=(DSORG=PS,R=CFM=FB,LRECL=80,BLKSIZE=6160)
39. //GO.SYSIN DD *

```

Figure 3.5

ORIGINAL PAGE IS
OF POOR QUALITY

```
1.      This program takes a file in EBCDIC format (FILE11)
2.      and stores it on tape in ASCII format.
3.
4.
5.      // JOB TIME=5,REGION=800K
6.      //STEP1 EXEC PGM=IEBGENER
7.      //SYSPRINT DD SYSOUT=A
8.      //SYSIN DD DUMMY
9.      //SYSUT1 DD DSN=MYL.CC.PUB.FILE11,DISP=SHR,
10.     //          UNIT=SYSDA
11.      //SYSUT2 DD DSN=ONE,UNIT=TAPE,DCB=(LRECL=80,BLKSIZE=80,RECFM=FB,
12.      // DEN=3,OPTCD=N),VOL=SER=CCT004,LABEL=(1,NL),DISP=(NEW,KEEP)
13.      /*
14.      //STEP6 EXEC PGM=PRESS
15.      //SYSPRINT DD SYSOUT=A
16.      //SYSIN DD DUMMY
17.      //SYSUT1 DD DSN=ONE,DISP=(OLD,KEEP),LABEL=(1,NL),VOL=SER=CCT004,
18.      // UNIT=TAPE,DCB=(LRECL=80,BLKSIZE=80,RECFM=FB,DEN=3,OPTCD=N)
19.      //SYSUT2 DD DSN=MYL.CC.PUB.NASA,UNIT=3330,DISP=(,CATLG),
20.      // VOL=SER=SCRO02,DCB=(LRECL=6233,BLKSIZE=6233,RECFM=U,DSORG=PS),
21.      // SPACE=(TRK,(400,5),RLSE)
22.      /*
23.      //
```

ORIGINAL PAGE 10
OF POOR QUALITY

Figure 3.6

PROGRAM CDATA

DEVELOPED BY: HARI P. SINGH
DECEMBER 1982

```

7 C THIS PROGRAM IS DESIGNED TO READ ASCII DATA OFF A TAPE, CONVERTS IT
8 C INTO HP FLOATING POINT FORMAT, AND THEN STORE IT IN A TYPE 1 FILE.
9 C IT IS ASSUMED THAT THE ORIGINAL DATA IS STORED ON THE TAPE IN 80
10 C COLUMN RECORDS 16(1X,2A2), AND THAT AFTER EVERY 2048 RECORDS A NEW
11 C FILE IS TO BE CREATED.
12 C
13 C INTEGER 1, ! GENERAL PURPOSE COUNTER
14 C + IBUFF(40), ! I/O BUFFER
15 C + IDC8(144), ! DATA CONTROL BLOCK FOR FMP CALLS
16 C + IERR, ! ERROR RETURN AFTER FMP CALLS
17 C + INAM(3), ! NAME OF THE TYPE 1 DISC FILE
18 C + ISIZE(2), ! SIZING INFORMATION FOR THE TYPE 1 FILE
19 C + ITYPE, ! FMP FILE TYPE
20 C + ITEMP, ! INTEGER AFTER CONVERSION FROM ASCII
21 C + J, ! GENERAL PURPOSE COUNTER
22 C + TRBUFF(3) ! FOR CALLS TO DECODE
23 C
24 C REAL RBUFF(64) ! BUFFER CONTAINING 64 REALS/RECORD
25 C
26 C DATA ISIZE /512,128,
27 C DATA ITYPE /1,
28 C
29 C
30 C010 WRITE(3,0025)
31 C025 FORMAT('WHAT DO YOU WANT TO NAME THIS FILE ')
32 C READ 'C3A2', INAM
33 C
34 C CALL CREAT(IDC8,IERR,INAM,ISIZE,ITYPE,ISC,32767)
35 C IF(IERR.LT.0) THEN
36 C + I FMP ERROR
37 C030 WRITE(1,0030) IERR ! WRITE ERROR MESSAGE
38 C FORMAT('FMP ERROR NUMBER ',14,' WHILE BUILDING DISC FILE')
39 C GO TO 9999 ! EXIT PROGRAM
40 C ENDIF
41 C
42 C DO 1000 IREC=1,512 ! (512 RECORDS)*(64 POINTS/RECORD)
43 C DO #900 J=1,4 ! 4 RECORDS ON TAPE MAKE ONE ON DISC
44 C READ(8,0100) IBUFF ! READ A RECORD
45 C FORMAT(40A2)
46 C FORMAT(1X,14,7X,40A2)
47 C
48 C THIS LOOP IS USED TO DECODE THE ASCII DATA. IN EACH OF THE EIGHT
49 C ITERATIONS, TWO OF THE 16 INTEGERS ARE DECODED. THE DATA ON TAPE
50 C IS LAID OUT IN THE FORM 16(1X,2A2). FIRST THREE WORDS ARE BROUGHT
51 C INTO TRBUFF. THESE WORDS CONTAIN 6 CHARACTERS:
52 C A LEADING BLANK, FOUR CHARACTERS REPRESENTING AN INTEGER, & ANOTHER BLANK
53 C THESE ARE THE INTEGERS IN POSITIONS (1,3,5,7,9,11,13,15)
54 C NEXT THE FOUR CHARACTERS REPRESENTING THE INTEGERS IN POSITIONS
55 C (2,4,6,8,10,12,14,16) ARE DECODED
56 C
57 C DO #900 I=1,8 ! DECODE 2 INTEGERS AT A TIME

```

```

57 TRBUFF(1)=IBUFF((I-1)*5)+1)
58 TRBUFF(2)=IBUFF((I-1)*5)+2)
59 TRBUFF(3)=IBUFF((I-1)*5)+3)
60 DECODE(6,0500,TRBUFF)ITEMP
61 TRBUFF((J-1)*16)+((I-1)*2)+1)=REAL(ITEMP)
62 TRBUFF(1)=IBUFF((I-1)*5)+4)
63 TRBUFF(2)=IBUFF((I-1)*5)+5)
64 DECODE(4,0500,TRBUFF)ITEMP
65 TRBUFF((J-1)*16)+((I-1)*2)+2)=REAL(ITEMP)
66 FORMAT(16)
67 CONTINUE
68 C
69 CONTINUE
70 C
71 WRITE(6,0905)RBUFF
72 FORMAT(4(16(1X,F5.0),/))
73 CALL WRITE(10CB,IERR,RBUFF)
74 IF(IERR.LT.0)THEN
75     WRITE(1,0920)IERR
76     FORMAT('FMP ERROR NUMBER ',I4, ' WHILE WRITTING TO DISK')
77     GO TO 9999
78     ENDIF
79 CONTINUE
80 C
81 WRITE(1,0930)
82     FORMAT('DO YOU WISH TO BUILD ANOTHER FILE (Y/N) ')
83     READ '(A2)',IANSUR
84     IF(IANSUR.EQ.1)HYGO TO 0010
85     CONTINUE
86 C
87     CALL CLOSE(10CB,IERR)
88     IF(IERR.LT.0)THEN
89         WRITE(1,9030)IERR
90         FORMAT('FMP ERROR NUMBER ',I4, ' WHILE CLOSING FILE')
91     ENDIF
92 C
93     END

```

FTN4X COMPILER: HP92834 REV.2226 (820503)

** NO WARNINGS ** NO ERRORS ** PROGRAM: 745 COMMON: (NONE)

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

4. User's Guide

This user's guide will provide the user with a step by step explanation of the questions that will be asked during a typical session with the simulator. References are given in each question so that the user can refer to the appropriate sections if an in depth discussion about the topic is desired (references made refer to the first report, "A Computer Simulator for a Mobile Telephone System", NASA Grant 3-119).

The following is a typical question-and-answer session with all the possible questions either being asked or presented in the explanation. The answers shown here are for a batch version version for a run. In an actual run, the answers shown would come out on the same line as the question. However we have seperated them here onto seperate lines for clarity. For an online session, merely the question will be prompted unto the user terminal, for which he would interactively enter his response.

The first question asked prompts the user as to whether the session is an online or batch session, and is displayed as follows:

Is this an online session? (Y/N) (1)

N

The user should answer a 'Y' if it is an online session, or an 'N' if it is a batch session. In this case the response is "N" (no).

Next, the type of calls that are available in the communication system are displayed as follows:

ORIGINAL PAGE IS
OF POOR QUALITY

communication system are displayed as follows:

TYPE OF CALL AVAILABLE: (2)

- 1: M1->M2, rural mobile to rural mobile in same UHF beam
- 2: M1->M3, rural mobile to rural mobile in different UHF beam, in same S-band
- 3: M1->M4, rural mobile to rural mobile in different UHF beam, in different S-band.
- 4: M1->FC1, rural mobile to fixed in same S-band beam
- 5: M1->FC2, rural mobile to fixed in different S-band beam
- 6: FC1->M1, fixed to rural mobile in same S-band beam
- 7: FC2->M1, fixed to rural mobile in different S-band beam

INPUT TYPE OF CALL TO BE SIMULATED:

1

Here the type of calls that are available in the communication system are displayed, each one being designated by a number from 1 through 7. Right after the list, the user is prompted to input the type of call he wishes to be simulated by inputting a number from 1 through 7. In this case, the first call ("1") was chosen. For an explanation of each of these calls, see section 2.2.

After the user has inputted the type of call to be simulated, the modes of call available within the type of call selected will be displayed (refer to section 2.3). In this case, the user chose to simulate type 1, which is rural mobile calling rural mobile in the same UHF-beam and S-beam. Correspondingly, the following choice of modes was displayed:

MODE OF CALL AVAILABLE: (3)

- 1: M1->M2, hard wired transponder
- 2: M1->M2, direct switched transponder
- 3: M1->M2, indirect switched transponder
- 4: M1->G1->M2, double hop system

INPUT MODE OF CALL TO BE SIMULATED:

1

Note that the type of modes that will be displayed depends on the type of call that is chosen (in this case type 1 was chosen). A full list of the range of possible modes corresponding to the

ORIGINAL PAGE 19
OF POOR QUALITY

type of call chosen is found in section 2.3. (table 2.3.1).

One notes that following the list of modes available, the user is prompted to input the mode of the call by entering its corresponding number. In this case the user chose "1", from a choice of 1 to 4.

Based on the type of call and mode of call selected, the program will determine which scenario to be simulated (refer to section 3.3). The questions asked from this point on will vary depending on the features to be simulated within the scenario. Even though each of the five scenarios are different, the questions to be answered for each of them are more or less of the same nature. Therefore the rest of our discussion will focus only on those questions that are asked when the single hop system is to be simulated (which is the case of this particular simulation run).

In the next question, the user is asked to choose from the types of signal sources available. Choice 1, corresponds to a program generated sinusoid which can be used for making analytical tests. If choice "1" is chosen, no further questions about the signal source are asked and question (4) is then displayed. Choice "2" corresponds to sampled voice. If type 2 is chosen, then see section 3.2 for an explanation of procedures to be used.

TYPES OF SIGNAL SOURCES AVAILABLE:

1: Program generated single tone sinusoid.

2: Sampled voice from tape source.

Choose type of signal to be used (11):

1

In the next question,

FREQUENCY OF THE BASEBAND SIGNAL (LESS THAN 3000 HZ.) (4)
(IN HERTZ, F7.2):

1000.00 HZ

ORIGINAL PAGE IS
OF POOR QUALITY

The user is asked to input the frequency of the baseband signal in hertz using the format "F7.2". The baseband signal has an upper limit of 3000 Hz (refer to section 5).

The next question displayed is as follows:

NOTE: POWER OF THE BASEBAND SIGNAL HAS TO BE LESS OR EQUAL (5)
 THAN .5 WATTS;
 SO THAT THE MAXIMUM INSTANTANEOUS FREQUENCY DEVIATION IS
 LESS OR EQUAL THAN 12000 HZ
 POWER OF THE BASEBAND SIGNAL (IN WATTS, F7.2): (6)
 0.50 WATTS

Here the user inputs the power of the baseband signal in watts using the format F7.2. The power of the baseband signal has to be less than or equal to .5 watts, so that the maximum instantaneous frequency deviation is less than or equal to 12000 Hz (refer to section 5).

In the next question that appears

THE CARRIER POWER (IN WATTS, F7.2): (7)
 1.00 WATTS

the user is asked to input the carrier signal power in watts using the format F7.2.

The next question appearing,

THE FREQUENCY DEVIATION (IN HERTZ, F8.2): 12000 HZ. (8)
 (FIXED FOR NOW)

asks the user to input the frequency deviation in Hertz using the format F8.2. Under the current version, the frequency deviation is fixed at 12,000 Hz in order for the simulator to meet AMPS specifications (refer to section 5).

The next question is displayed as follows:

How many times the nyquist rate do you want the sampling (9)
 frequency to be? (2 - 4, I1):

ORIGINAL PAGE IS
OF POOR QUALITY

Here the user is asked to input the sampling frequency in terms of a multiple of the Nyquist rate. Acceptable values are from twice the nyquist rate to four times the Nyquist rate. Twice the Nyquist rate is the minimum in order for the simulator to intergrate and differentiate correctly. Four times the Nyquist rate is the maximum since any increase of the sampling frequency beyond this point will not improve any significant approximation, but will prolong run time substantially (refer to section 3.2).

In the next question,

THE CARRIER FREQUENCY (IN HERTZ, F7.2):(NOT USED FOR NOW) (10)

the user is asked to input the carrier frequency in Hertz using the format F7.2. Under the current version of the simulator, the carrier frequency is not used in the simulation.

The next question is displayed as follows:

DO YOU WANT THE COMPRESSOR/EXPANDER IN? Y-YES , N-NO : (11)
Y

Here the user is asked whether the compressor/expander (AMPS specs) are used in the transmitter and receiver (refer to section 5). This question is answered either with a "Y" (yes) or an "N" (no).

The next question appears as follows:

DO YOU WANT THE PRE-EMPHASIS - DE-EMPHASIS FILTERS IN ? (12)
Y-YES , N-NO :
Y

Here the user is asked whether pre-emphasis and de-emphasis filters (AMPS specs) are used in the transmitter and receiver (see section 5).

The user is then prompted as to whether or not interference is

ORIGINAL P. 11 OF POOR QUALITY

present in the UHF uplink satellite channel. This question is displayed as follows:

DO YOU WANT A CO-CHANNEL INTERFERER IN THE UPLINK? (13)
Y-YES,N-NO:

Y
Are multiple values of the carrier to interference power ratio to be tested? (Y/N): (14)

Y
Input the range of values to be tested (in DB):
Input the initial value (-99 -- +99,I3): (15)

10 DB
Input the increment value (01 -- 99,I3): (16)

10 DB
Input the final value (01 -- 99,I3): (17)

70 DB
Are multiple values of the interference phase values to be tested? (Y/N): (18)

Y
Input the range of values to be tested (in degrees):
Input the initial value (F6.2) : (19)

10.00 DEGREES
Input the increment value (F6.2) : (20)

5.00 DEGREES
Input the final value (F6.2) : (21)

25.00 DEGREES

Note the answer to the first of these questions was "Y" (yes). If the response was "N" (no interference), then the next eight questions would not have appeared. However, since in this case the response is yes, they did appear. In the first of these questions (14), the user is asked if he wishes to input a range of values for the carrier to interference power ratio. If the answer is "Y" (yes), as in this case, then questions 15-17 will follow. Here, the user inputs the initial value, increment value, and final value respectively (in dB, using the format I3) of the carrier to interference power ratio. If the answer to question (14) was "N" (no), then the user would have just been asked to input one value of the carrier to interference power ratio in the same format as above. After question 17, the user is asked whether he wants to

OF POOR QUALITY

input a range of phase values for the interference source (question 18). If the response to this is "Y" (yes), then questions 19-21 will appear, asking the user to input the initial, incremental, and final value of the phase, respectively (using format F6.2, in degrees). If the response to question 18 was "N" (no), then a question would have appeared asking only one value for the phase.

In the next question,

IS FADING PRESENT IN THE UPLINK CHANNEL? Y-YES,N-NO: (22)
Y

one responds as to whether or not the uplink satellite channel is a fading channel or not. One responds to the question by either typing a "Y" for yes or a "N" for no. If the response is no, the next five questions (questions 23-28) will not appear. However, as in this case, if the response is yes, then questions 24 through 28 will definitely appear. If interference is present, as is the case in the current simulation run, then question 23 will also appear. If interference were not present in the uplink, then question 23 would have not been asked. Questions 23-28 are displayed as follows:

IS THE INTERFERENCE FADED? Y-YES,N-NO: (23)
Y

THE UPLINK FADING CHANNEL IS PRESENT
TYPES OF FADING CHANNELS AVAILABLE: (24)
1: NO SPECULAR COMPONENT (RALEIGH FADING)
2: SPECULAR COMPONENT, SHORTEST PATH
3: SPECULAR COMPONENT, MEAN PATH
INPUT TYPE OF CHANNEL:

2
ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): (25)

500.00 MICROSECONDS
ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): (26)
1.00 HZ

OF POOR QUALITY

Are multiple values of the specular to multipath power ratio to be tested? (Y/N) : (27)

N

ENTER THE SPECULAR-TO-MULTIPATH POWER RATIO (IN DB, I3): (28)
100 DB

In the first of these questions, the user responds as to whether or not the interference is effected by the fading channel. If it is, it is done so independently of the signal and is added at the end. If it is not, then the interference is just added to the faded signal.

In the second of these questions, the user decides which type of fading is present, by entering a 1 digit number from 1 to 3 corresponding to the type of fading that is present. If (1) is chosen, then the fading channel will be a Rayleigh distributed one with no specular component. If (3) is chosen, then the channel will have Rician statistics, with the specular component in the middle. In other words, the mean path is taken. In the last case, (2), the channel has Rician statistics with the shortest path being taken (refer to section 6).

In the third of these questions (25), the user is asked to input the total multipath spread time of the fading channel in microseconds using the format F9.2. In this case, "500.00" was entered as data.

In question (26), the user is asked to input the doppler spread bandwidth of the fading channel in Hertz using the format F7.2. In this case the number "1.00" was entered as data.

Question (27) will only be asked if the response to question (24) is either 2 or 3. If the response is 1, then Rayleigh fading is being used which exhibits no specular component. Question (27)

ORIGINAL PAGE IS
OF POOR QUALITY

once again asks whether or not the user wishes to input a range of values for the specular to multipath power ratios (in dB). In this case the answer is "N" (no), and thus question (28) appears, which asks the user to input only one value of the specular to multipath power ratio (in dB) using the format I3 (in this case 100 was entered as data). If the response to question (27) was yes, then three questions asking for the initial, incremental, and final values respectively (using the same input format as question (28)) would have been displayed as they have in the questions asked previously.

The next question,

DO YOU WANT A CO-CHANNEL INTERFERER IN THE DOWNLINK? (29)

Y-YES, N-NO:

Are multiple values of the carrier to interference power ratio to be tested? (Y/N) : (30)

N

INPUT CARRIER TO INTERFERENCE POWER RATIO IN DB(I3): (31)

30 DB

Are multiple values of the interference phase values to be tested? (Y/N): (32)

N

INPUT PHASE OF INTERFERENCE IN DEGREES (F7.2): (32.1)

30.80 DEGREES

is the dual of the uplink interference case. The data entry is exactly the same as it were for the uplink case. Note however, in this case that the responses to the questions asking if the user wants to input a range of values are both negative. In this case the user is only inputting single values (030 dB for the power ratio, and 30.80 Degrees for the phase).

The next question,

IS FADING PRESENT IN THE DOWNLINK CHANNEL? Y-YES, N-NO: (33)

Y

OF POOR QUALITY

is basically the dual of the uplink case, the only exception however is the facility for a space diversity receiver. Once again, if the response to the above question is "N" (no), then questions 34 through 45 will not be asked. If the response is "Y" (yes), the next question that will be displayed is:

IS A SPACE DIVERSITY RECEIVER BEING USED? Y-YES,N-NO: (34)
Y

If a space diversity receiver is being used (response "Y"), as is the case for this example, then parameters for 2 fading channels will have to be set; questions 36 through 40 for the first channel and questions 41 through 45 for the second channel. If a space diversity receiver is not being used (response "N"), then the user will only be prompted to enter parameters for one channel.

If co-channel interference is present in the downlink channel (response to (29) is "Y"), then the following question will be displayed:

IS THE INTERFERENCE FADED? Y-YES,N-NO: (35)
Y

Here one enters whether or not the interference should be faded. If yes (as in this case), the user enters a "Y", and if not, the user enters an "N".

Questions 36 through 40 or questions 36 through 45 if a space diversity receiver is present, are entered in an analagous way as were the questions for the uplink satellite channel.

THE DOWNLINK FADING CHANNEL IS PRESENT
SET PARAMETERS FOR FIRST FADING CHANNEL: (36)
TYPES OF FADING CHANNELS AVAILABLE:
1: NO SPECULAR COMPONENT (RALEIGH FADING)
2: SPECULAR COMPONENT, SHORTEST PATH
3: SPECULAR COMPONENT, MEAN PATH

ORIGINAL PAGE IS OF POOR QUALITY

INPUT TYPE OF CHANNEL:

2
ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): (37)
500.00 MICROSECONDS
ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): (38)
1.00 HZ
Are multiple values of the specular to multipath power ratio to be tested? (Y/N): (39)

N
ENTER THE SPECULAR-TO-MULTIPATH POWER RATIO (IN DB, I3): (40)
100 DB
SET PARAMETERS FOR THE SECOND FADING CHANNEL: (41)

TYPES OF FADING CHANNELS AVAILABLE:

- 1: NO SPECULAR COMPONENT (RALEIGH FADING)
- 2: SPECULAR COMPONENT, SHORTEST PATH
- 3: SPECULAR COMPONENT, MEAN PATH

INPUT TYPE OF CHANNEL:

2
ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): (42)
500.00 MICROSECONDS
ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): (43)
1.00 HZ
Are multiple values of the specular to multipath power ratio to be tested? (Y/N): (44)

N
ENTER THE SPECULAR-TO-MULTIPATH POWER RATIO (IN DB, I3): (45)
100 DB

In the next question,

Are multiple SNR values to be tested? Y=yes, N=no: (46)
Y

the user is asked whether multiple SNR values are to be tested. If the response is "Y" (yes), then questions 47.1 through 47.3 will appear asking the user to input the range of SNR's (in this case, the carrier to noise ratio) for the Gaussian noise in the mobile receiver. If multiple SNR values are not to be tested (response "N"), then the user will be asked to input only one SNR value.

Questions 47.1/47.3 would appear as follows:

ORIGINALS IN THE
OF POOR QUALITY

[illegible]

In the next question,

IS A SPACE DIVERSITY RECEIVER REQUIRED? (Y/N) (48)
Y

the user is asked whether or not a space diversity receiver is to be used. If it is present (response "Y"), then the user will be asked (next question) to input the duration of the decision period which is the duration of the lapse time before a decision is made to determine which receiver is receiving a stronger signal. If it is not present (response "N"), then the next question (49) will not displayed.

INPUT DURATION BETWEEN DECISION TIMES FOR THE S.D. RECEIVER
(F7.5, IN SECONDS) 0.00020SEC. (49)

The next question is displayed as follows:

```

Input the approximate duration of simulation in seconds      (50)
(0.01 - 9.99, F4.2):      0.01 SEC.

```

Here the user inputs the approximate duration of the input signal to be tested in seconds using the format F7.5. For now, the boundary imposed is from 0.01 seconds to 9.99 seconds (refer to section 4.1).

In the next question displayed,

```

Type of performance measurement available: (51)
  1. Compare recovered output signal to original input signal
  2. Measure output signal to noise ratio
Input type:

```

ORIGINAL FACTS
OF POOR QUALITY

the user is asked to input the type of performance to be measured. Under the current version, the user has the choice of choosing either to compare the recovered output signal to the original input signal (choice "1"), or (choice "2") to measure the output signal to noise ratio vs input signal to noise ratio (refer to section 4.2). If choice 2 is chosen, the user will be asked if he wishes that a plot be displayed of the input vs output SNR values. asked. However, if choice 1 is chosen, as is the case in this example, than the following will be the last question displayed:

DO YOU WANT OUTPUT TO BE PLOTTED? (52)

Y

Here the user has the option of having the output vs input signals plotted. If the response to this question is "Y" (yes), then following the printing of the input vs output signal values (for each respective SNR value), a graph will be plotted corresponding to these values. The maximum possible length of the graph is 2000 lines (per SNR value). If the response is "N" (no), then just the values without a graph will be printed.

A few lines of the resulting output are printed as follows:

UNIFORMITY
OF POOR QUALITY

Input signal	Output signal (No Noise)	Output signal (With Noise)
<hr/>		
The SNR is 36.00 DB		
0.1000000E 01	-0.3008653E 02	0.6992087E 02
0.9972572E 00	-0.9639141E 03	0.2256493E 04
0.9890135E 00	-0.7375438E 04	0.1755339E 05
0.9752213E 00	-0.2662992E 05	0.6575075E 05
0.9557958E 00	-0.6205368E 05	0.1653216E 06
0.9306050E 00	-0.1081285E 06	0.3328434E 06
0.8994539E 00	-0.1487061E 06	0.5898719E 06
0.8620588E 00	-0.1609989E 06	0.9725955E 06
0.8180044E 00	-0.1277967E 06	0.1540994E 07
0.7666720E 00	-0.5651906E 05	0.2387130E 07
0.7071075E 00	-0.7818813E 03	0.3643070E 07
0.6377603E 00	0.7991531E 05	0.5487024E 07
0.5558942E 00	0.4918778E 06	0.8145275E 07
0.4559756E 00	0.1515125E 07	0.1188825E 08
0.3233112E 00	0.3496630E 07	0.1701875E 08
0.1490450E-02	0.6825587E 07	0.2384659E 08
-0.3233029E 00	0.1189424E 08	0.3265666E 08
-0.4559686E 00	0.1904904E 08	0.4366894E 08
-0.5558881E 00	0.2853454E 08	0.5699677E 08
-0.6377543E 00	0.4043526E 08	0.7258918E 08
-0.7071018E 00	0.5462040E 08	0.9018307E 08
	:	
	:	
	:	
	:	

ORIGINAL
OF POOR

```

720. -0.8134990E 00 -0.3250146E 05 -0.3252382E 05
721. -0.7462617E 00 -0.3871931E 05 -0.3873486E 05
722. -0.6746396E 00 -0.4453807E 05 -0.4455445E 05
723. -0.5940157E 00 -0.4990534E 05 -0.4991791E 05
724. -0.5066984E 00 -0.5476577E 05 -0.5477025E 05
725. -0.4138190E 00 -0.5906239E 05 -0.5905626E 05
726. -0.3164213E 00 -0.6273980E 05 -0.6271593E 05
727. -0.2155438E 00 -0.6574794E 05 -0.6570694E 05
728. -0.1123206E 00 -0.6804550E 05 -0.6800881E 05
729. -0.7652316E-02 -0.6960200E 05 -0.6958081E 05
730. 0.9668676E-01 -0.7039825E 05 -0.7038119E 05
731. 0.2001823E 00 -0.7042663E 05 -0.7040781E 05
732. 0.3014705E 00 -0.6968919E 05 -0.6967275E 05
733. 0.3994715E 00 -0.6819650E 05 -0.6818431E 05
734. 0.4930838E 00 -0.6596506E 05 -0.6595363E 05
735. 0.5813091E 00 -0.6301504E 05 -0.6299994E 05
736. 0.6631559E 00 -0.5936834E 05 -0.5935133E 05
737. 0.7377312E 00 -0.5504795E 05 -0.5503618E 05
738. 0.8042567E 00 -0.5008057E 05 -0.5008200E 05
739. 0.8619032E 00 -0.4450350E 05 -0.4452383E 05
740. 0.9102221E 00 -0.3837407E 05 -0.3841241E 05
741. 0.9485188E 00 -0.3177484E 05 -0.3181984E 05
742. 0.9764272E 00 -0.2480832E 05 -0.2484691E 05
743. 0.9936365E 00 -0.1758397E 05 -0.1761883E 05
744. 0.9999666E 00 -0.1020682E 05 -0.1023401E 05
745.

```

```

=====
*=INPUT SIGNAL, +=OUTPUT-NO NOISE, -=FADED OUTPUT
*: 1-SPACE= 0.181818E-01
+: 1-SPACE= 0.128063E 04
?: 1-SPACE= 0.128119E 04

```

```

746.
747.
748.
749.
750.
751.
752.
753.
754.
755.
756.
757.
758.
759.
760.
761.
762.
763.
764.
765.
766.
767.
768.
769.
770.
771.
772.
773.
774.
775.
776.
777.
778.
779.

```

```

=====
*=INPUT SIGNAL, +=OUTPUT-NO NOISE, -=FADED OUTPUT
*: 1-SPACE= 0.181818E-01
+: 1-SPACE= 0.128063E 04
?: 1-SPACE= 0.128119E 04

```

ORIGINAL PAGE IS
OF POOR QUALITY

5. Sample Runs -----

One of the biggest advantages of the present simulator is its ability to span over a range of inputs for the different devices, as opposed to only entering one value at a time as was the case in the previous simulation. This facility is illustrated in figure 1. In this particular example, 4 parameters are variables: the specular to multipath power ratio of the UHF downlink channel, the carrier to interference power ratio of the UHF downlink co-channel interferer, the phase values for the UHF downlink co-channel interferer, and the input signal to noise ratio of the Gaussian noise source. One can see from figure 1 that every possible permutation of the above values is exhibited. In this simulation run, a type one measurement is chosen with the plotting facility on. Thus the output is a list of the input vs. output values of the system, followed by its corresponding plot. One notes that a type one output exists for each of the possible permutations as mentioned above.

Figure 2 illustrates the above mentioned "looping" feature for a type 2 measurement. In this output, a type 2 measurement of the input vs. output SNR values and its corresponding plots are exhibited for every possible permutation of the 7- input parameters (columns) shown.

In figure 3, the output SNR values are being plotted as a function of the input SNR values for different values of the carrier to interference power ratio of the UHF uplink interference source. Again, the looping facility is exhibited here. One notes

PRECEDING PAGE BLANK NOT FILMED

ORIGINAL PAGE IS
OF POOR QUALITY

from the output curves, that as the carrier to interference power ratio gets smaller, the output curves flatten out. At large values, the curves remain linear above threshold as expected.

Figure 4 illustrates the execution of a double hop system (scenario 2 in this case). One notes here that both an S-band and an UHF band uplink channel are set, as well as an S-band and an UHF band downlink channel.

ORIGINAL PAGE IN
OF POOR QUALITY

6. Results

The results of the present simulator are divided into two sections; The analytical results (section 6.1), and the processed voice results (section 6.2). In both cases, tests are made using a single hop system (scenario 1).

6.1 Analytical Results

The system discussed can be seen to have the responses shown on various plots obtained for several different Rician channels over a single hop system (scenario 1).

We first analyzed a single hop system over a channel without fading or interference present as a function of the input SNR values. A pure sinusoid was used as input. The results can be seen in figure 6.1 (referenced from first report). Note that the results are analyzed for various combinations of signal processing stages. These results represent a pure FM system with white noise present.

We next simulated a single hop system over a Rician channel with no interference present, and analyzed the output vs input SNR values for various values of the specular-to-multipath component power ratios of the fading channel. The results are summarized in the plot of figure 6.2. First, we note that when the specular-to-multipath power ratio of the channel is 100 db, no

ORIGINAL PAGE OF PAPER

real effects of fading can be seen and the output vs input SNR curve remains a linear one as expected. An analysis of the various plots, however, does show that as the specular-to-multipath power ratio is decreased, a flattening out of the linear curve does occur and the effects of fading become increasingly destructive.

We next analyzed a single hop system over a Rician channel with no interference present, with and without a space diversity receiver present. The results are summarized in figure 6.3. One observes from this plot that there is a significant improvement with the space diversity receiver on.

We next plotted the output signal-to-noise ratio as a function of the specular-to-multipath power ratio of the fading channel, with no other disturbances present. We started with a specular-to-multipath power ratio of -35 dB (practically Raleigh fading), and went all the way up to a specular-to-multipath power ratio of 100 dB. The results are summarized in figure 6.4. Here we noticed a threshold effect beginning at a specular-to-multipath power ratio of about +05 dB. The curve moves up very quickly in a linear fashion from 5 dB to 50 dB, and then flattens out to its maximum value.

Figure 6.5 considers the effects of interference on the output signal to noise ratio. One can observe from the plot that an interference source with a carrier to interference power ratio ranging from 100 dB all the way down to 20 dB has no major effect on the output performance. However, as one gets below 20 dB, a flattening out of the input vs. output SNR curve does occur above

ORIGINAL QUALITY OF PLOT QUALITY

threshold. As the carrier to interference power ratio is taken below 8 dB, the flattening out effects become very predominant and output performance starts getting poor. At 0 dB, the curve flattens out completely to about .5 dB (Threshold effect).

Figure 6.6 considers results obtained using scenario 2. In this plot we analyze the input vs. output SNR values of a double hop system assuming all four channels are Rician fading channels. The UHF uplink channel, the S-band downlink channel, the S-band uplink channel, and the UHF downlink channel are the channels which are considered. As one can see from the plot, various permutations of the 4 channels (specular to multipath power ratio of the fading channel is varied) are considered.

These are just a few of the vast number of results obtainable with this simulation. Section 5 contains various sample runs illustrating some of the various possible results obtainable.

ORIGINAL PAGE IS
OF POOR QUALITY

6.2. Results: Voice

In addition to the analytical results, we were also able to use the simulation to process sampled voice and actually listen to it. In particular, the following tests were made on the voice:

First, we put the sampled voice through the simulation with no fading, interference, or thermal noise present, or in other words, "pure FM". The output voice sounded exactly the same as the input. We listened to the voice (still pure FM) with the pre-emphasis de-emphasis filters both off and on, and could hear a slight improvement with the latter case. With the expander - compander on or off, difference in voice quality was too slight to be heard.

Next, with no other disturbances present, we listened to the voice as a function of the thermal noise power. Results could be summarized as follows:

Carrier-to-Noise Power Ratio (dB)	Speech Quality
-----	-----
+40	Excellent
+35	Excellent
+30	Excellent
+25	Excellent
+20	Excellent
+16	Very good
+14	Good
+12	Good (very light static)
+10	Fair (light crackling)
+08	Fair-Poor (crackling louder)
+06	Poor (crackling loud)
+03	Very Poor (Basically only crackling)
-02	No sign of voice (only loud crackling)

ORIGINAL PAGE IS
OF POOR QUALITY

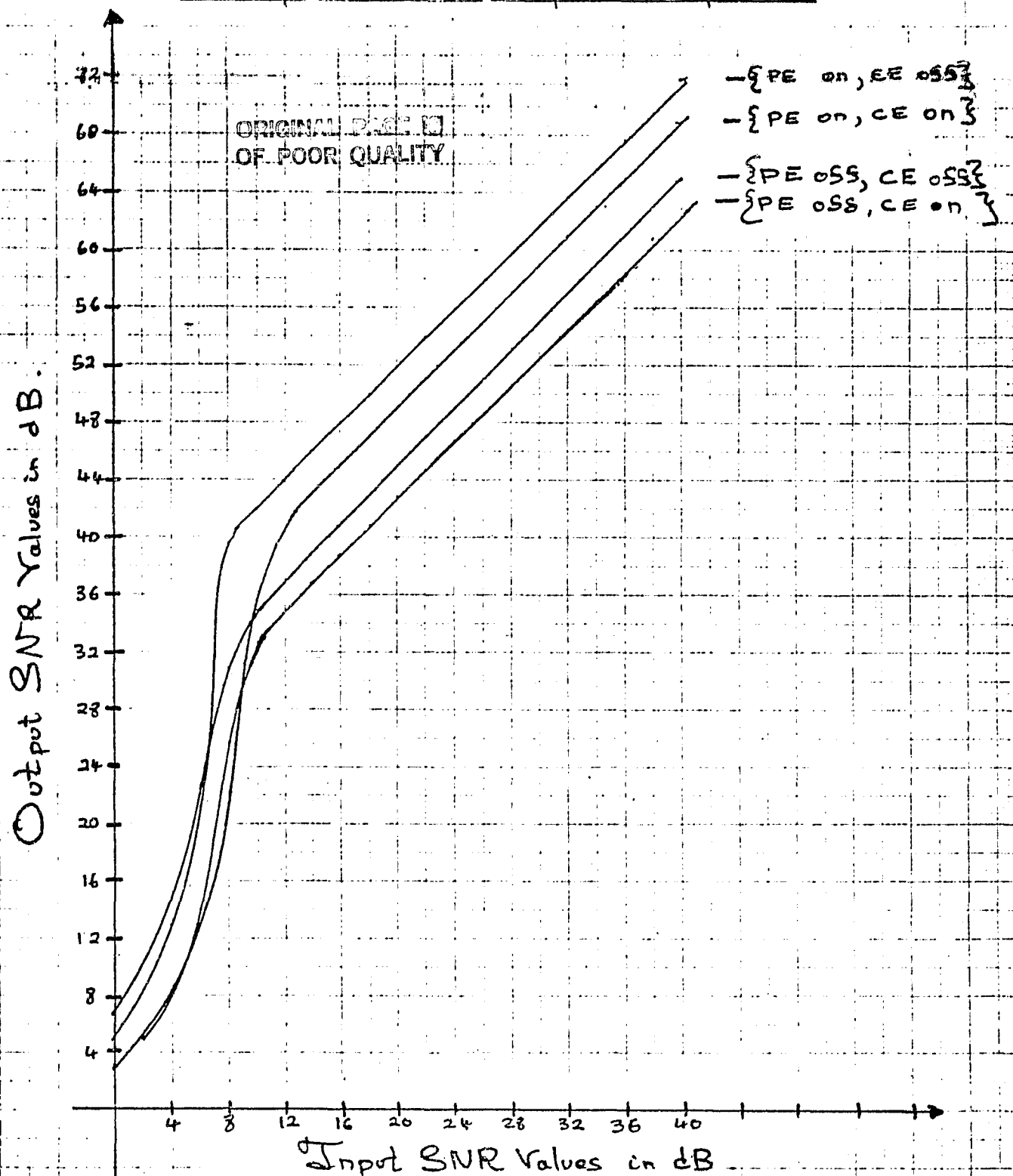
As the above indicates, the quality of voice went from excellent just above threshold, to poor just below threshold, consistent with our analytical results as well as theoretical results.

We then listened to the voice as a function of the specular-to-multipath power ratio (dB) of the fading channel (see sample run 5.1 for channel parameters), with no other disturbances present (input carrier-to-noise power ratio at +40dB). Within the range of specular-to-multipath power ratios from +6 dB and better, output voice quality was excellent. Within the range from -10 dB through +6 dB, voice quality was good (tonal characteristics of the voice were altered somewhat). Below -12 dB, voice quality was fair (tonal characteristics altered), with some crackling present.

The above examples are a few of the many possible tests on voice. Any of the 5 scenarios can be tested on the voice, with all possible parameter variations. (note that the above tests correspond to scenario 1).

FIGURE
B.1

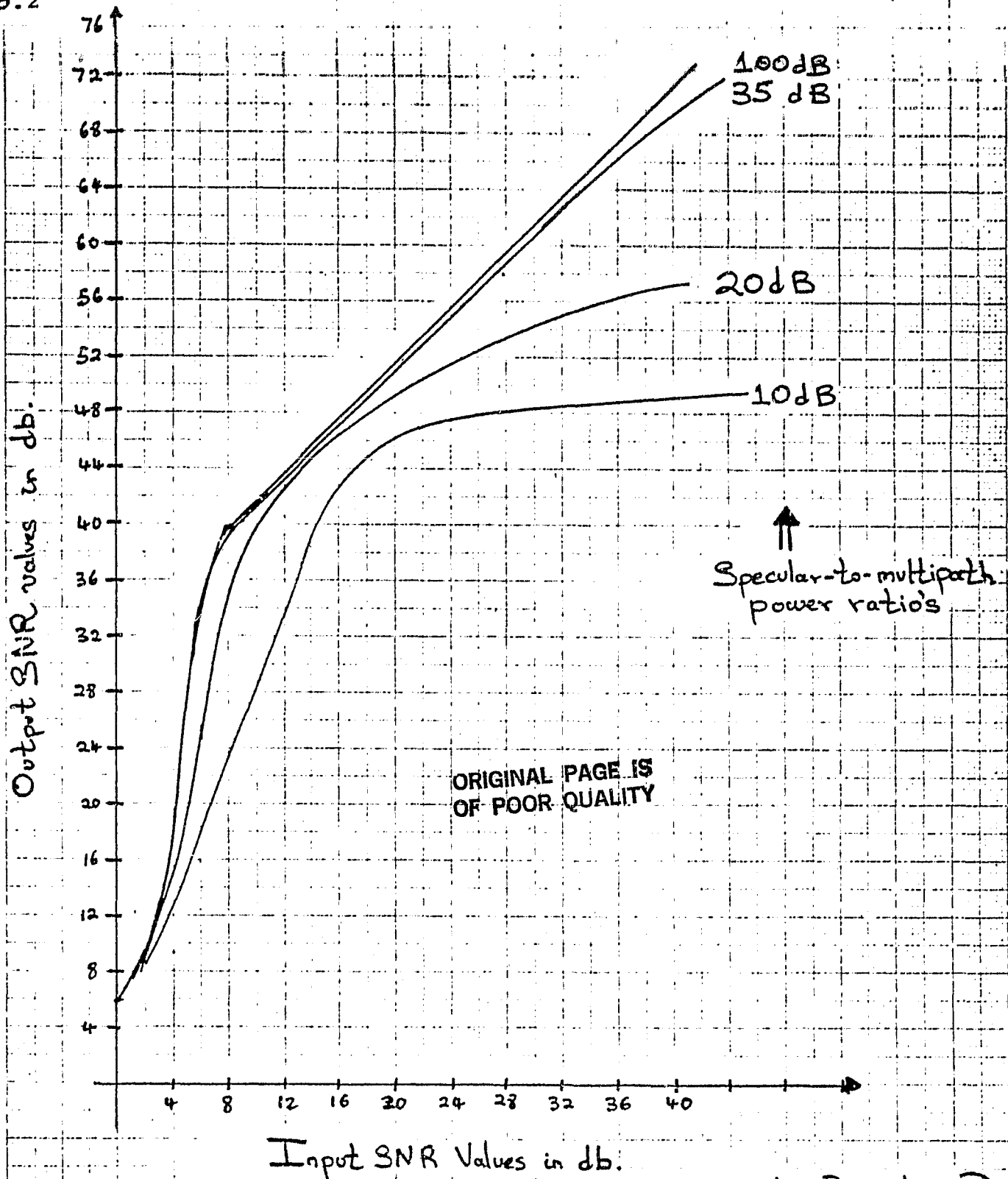
Input vs Output SNR Curves with and without Pre-emphasis/
De-emphasis and/or Compressor/Expander



PE - Pre-emphasis-De-emphasis
CE - Compressor - Expander.

FIGURE
6.2

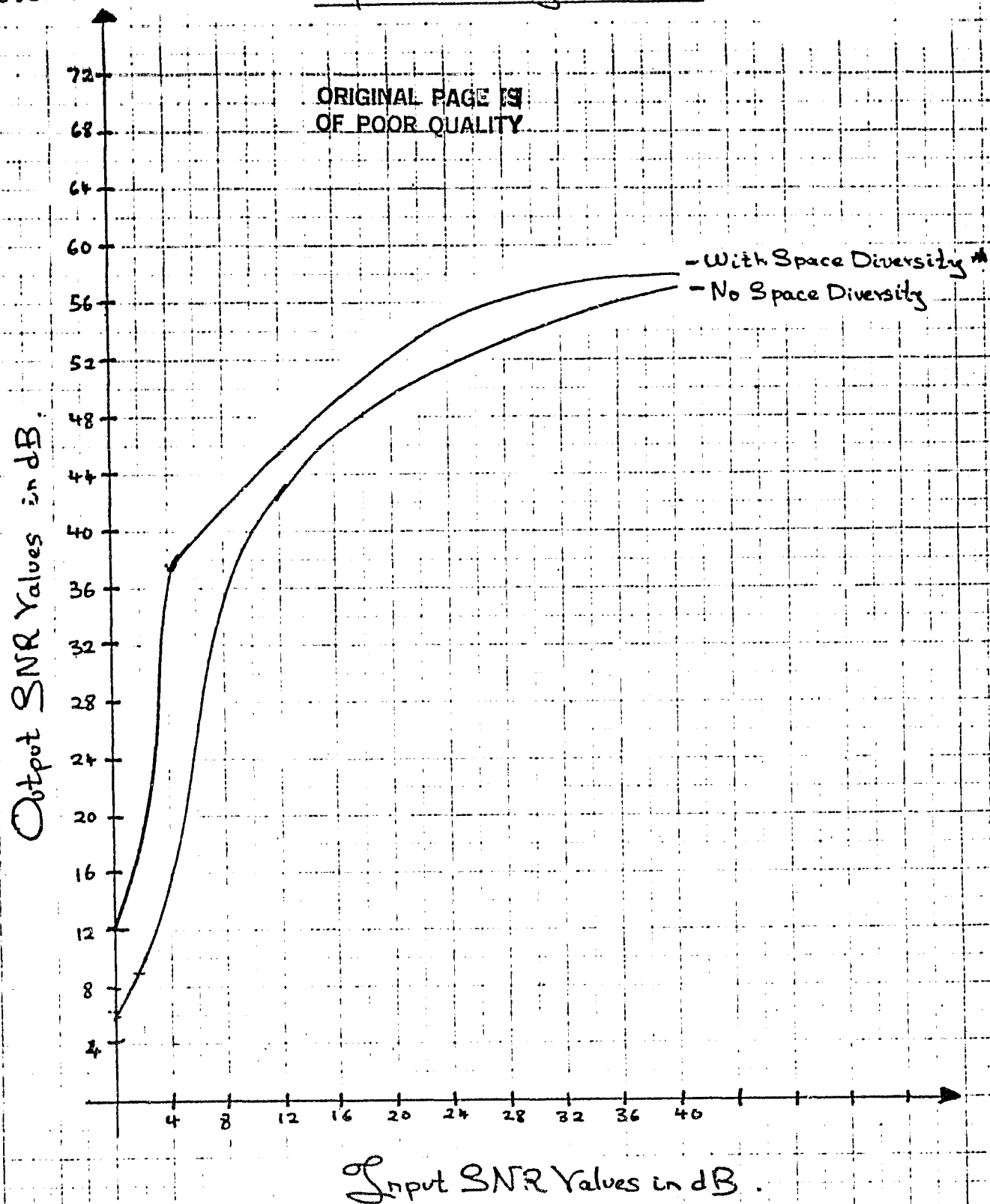
Input vs. Output SNR values for Rician Fading



Note: Pre-emphasis
De-emphasis
Compressor/
Expander.

FIGURE 6.3

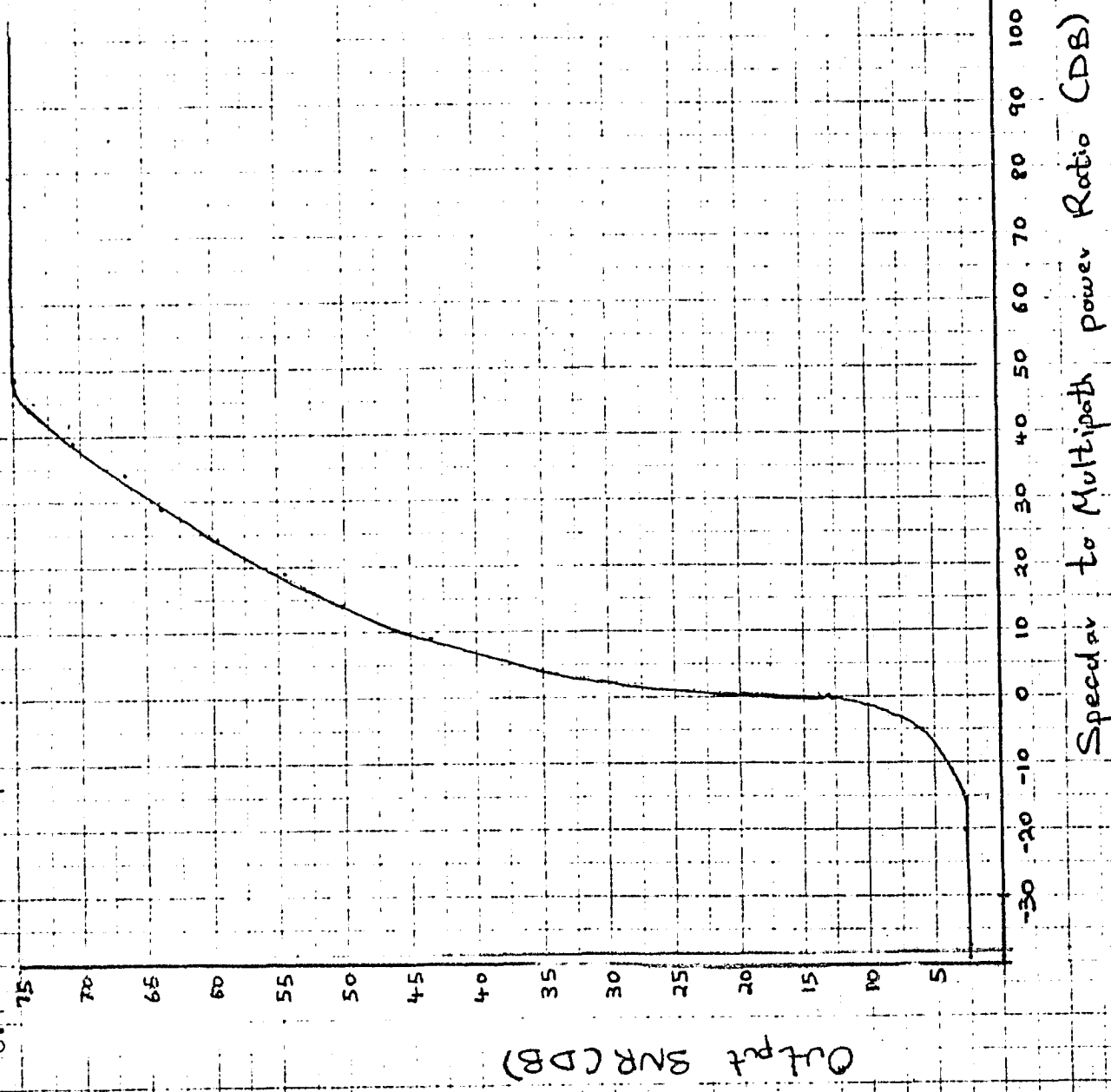
Output vs Input SNR Values with and without Space Diversity Receiver



Specular-to-multipath
power ratio = 20dB,
for both cases.

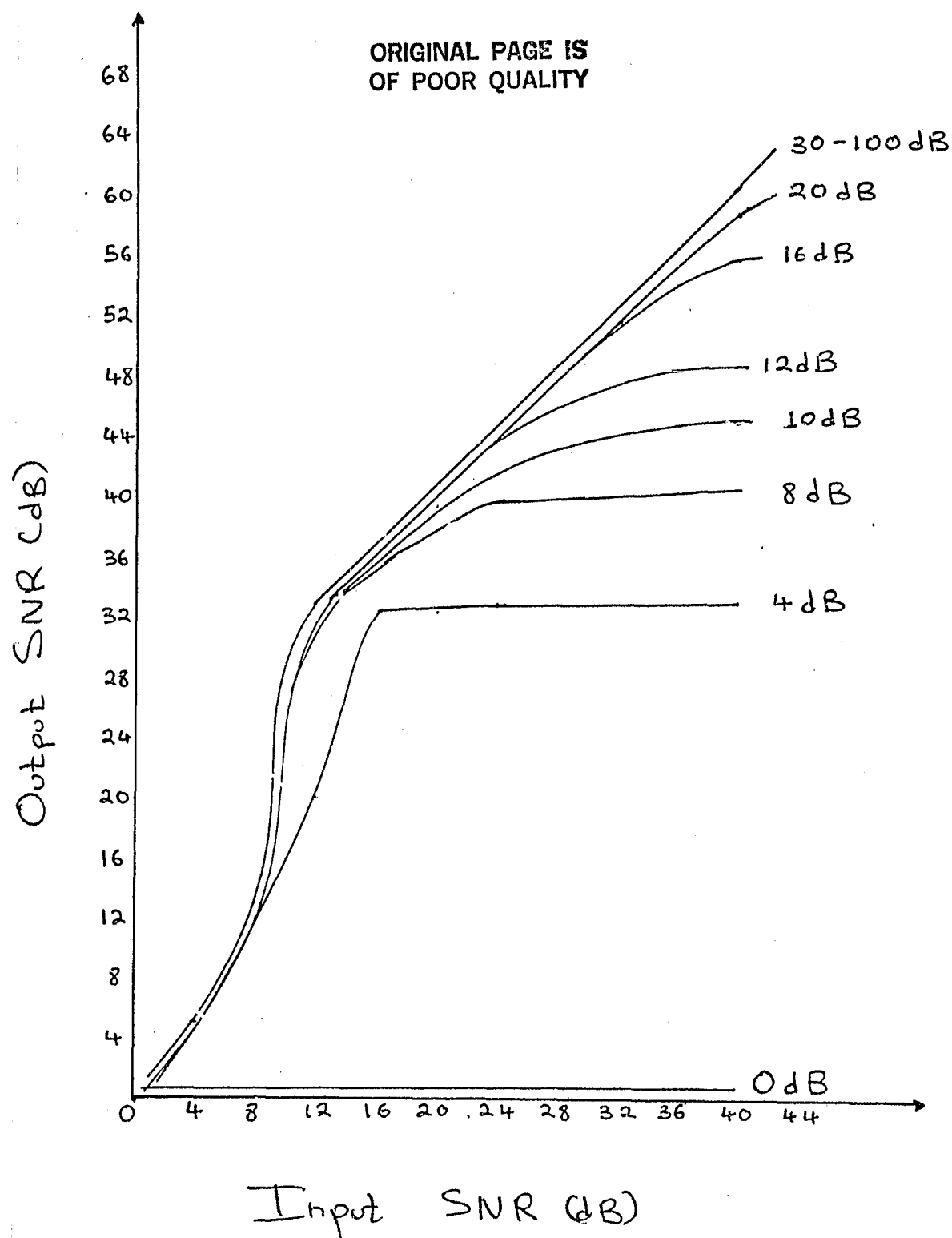
* Decision time = 0.000016 sec

FIGURE 6.4
Speeder-to-Multipath power ratio vs Output SNR.

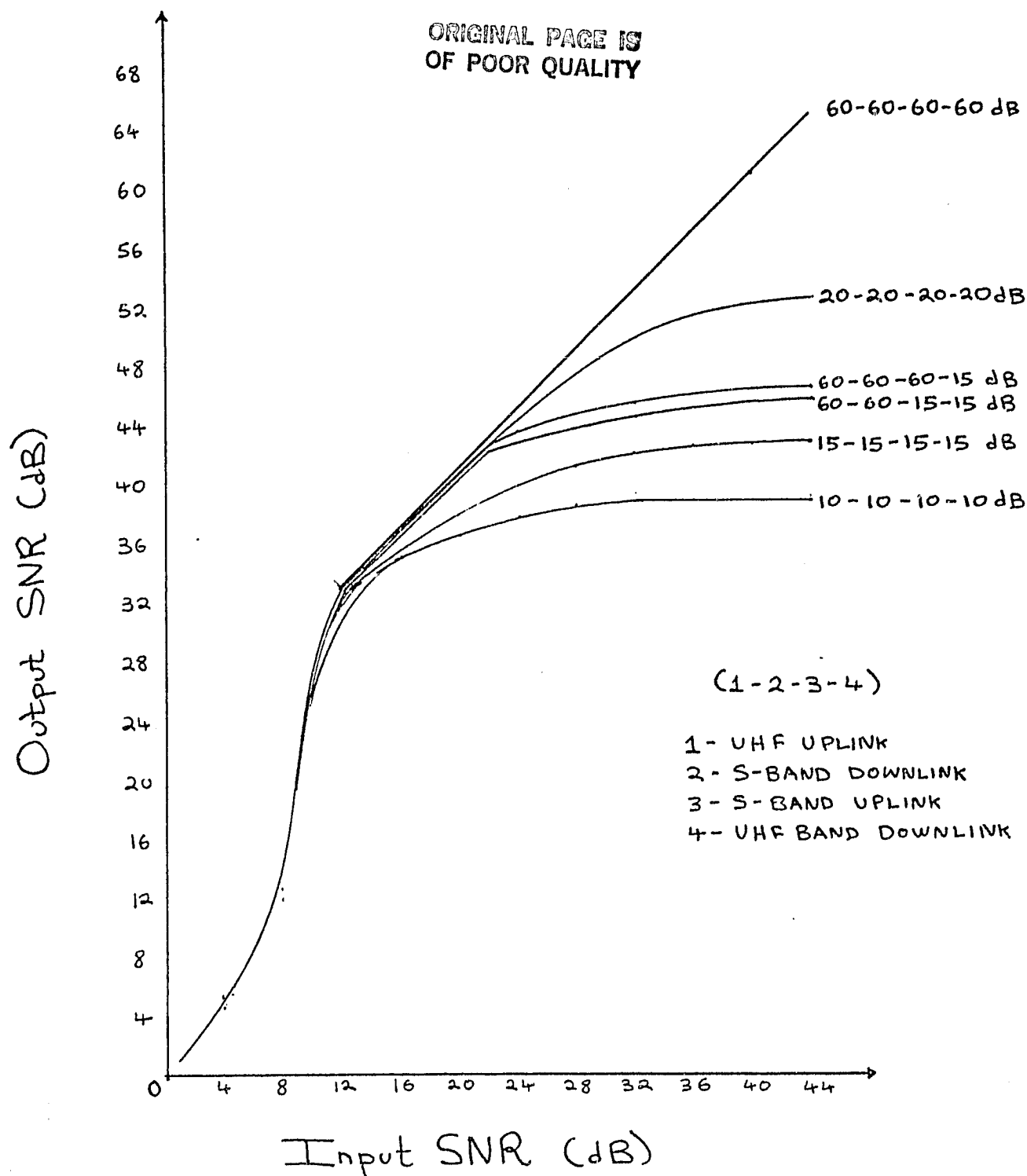


ORIGINAL PAGE IS
OF POOR QUALITY

6.5 Output vs Input SNR as a function of.
the Carrier-to-Interference Power Ratio



6.6 Multi-channel Performance of a Double Hop System (Scenario 2)



ORIGINAL PAGE IS
OF POOR QUALITY

7. Proposed Research for the Forthcoming Year

Because of the present system's very modular structure, simulation of other modulation techniques over any one of the five scenarios can be done with relative ease. Since the simulation is designed in such a way that the inphase and quadrature phase components of the input signal are being passed through the components of the system in a parallel fashion, any type of modulation scheme which can be broken up into these components can be easily implemented. For example, the present simulator could be used to test the performance characteristics of duo-binary FM or tamed FM, both which use less bandwidth than standard FM.

At the same time, one could use the simulation to process voice using various modulation techniques to see which types produce the best subjective voice quality. In the report, we propose to construct a system to allow for simple testing of actual voice input. This system will allow for simple interfacing of voice input to the IBM system on which the actual simulation took place. We plan to build this device using a personal computer as the controller.

Also because of the systems modular structure, it would be possible test other types of components or noise sources.

1. Is this an online session? (Y/N) N
2.
3.
4. TYPE OF CALL AVAILABLE:
5. 1: M1->M2, rural mobile to rural mobile in same UHF beam
6. 2: M1->M3, rural mobile to rural mobile in different UHF beam, in same S-band
7. 3: M1->M4, rural mobile to rural mobile in different UHF beam, in different S-band
8. 4: M1->FC1, rural mobile to fixed in same S-band beam
9. 5: M1->FC2, rural mobile to fixed in different S-band beam
10. 6: FC1->M1, fixed to rural mobile in same S-band beam
11. 7: FC2->M1, fixed to rural mobile in different S-band beam
12. INPUT TYPE OF CALL TO BE SIMULATED: 1
13.
14. MODE OF CALL AVAILABLE:
15. 1: M1->M2, hard wired transponder
16. 2: M1->M2, direct switched transponder
17. 3: M1->M2, indirect switched transponder
18. 4: M1->G1->M2, double hop system
19. INPUT MODE OF CALL TO BE SIMULATED: 1
20.
21. FREQUENCY OF THE BASEBAND SIGNAL (LESS THAN 3000 HZ.) (IN HERTZ, F7.2): 1000.00 HZ
22.
23. NOTE : POWER OF THE BASEBAND SIGNAL HAS TO BE LESS OR EQUAL THAN .5 WATTS:
24. SO THAT THE MAXIMUM INSTANTANEOUS FREQUENCY DEVIATION IS
25. LESS OR EQUAL THAN 12000 HZ
26. POWER OF THE BASEBAND SIGNAL(IN WATTS, F7.2): 0.50 WATTS
27.
28. THE CARRIER POWER (IN WATTS, F7.2): 1.00 WATTS
29.
30. THE FREQUENCY DEVIATION (IN HERTZ, F8.2): 12000 HZ. (FIXED FOR NOW)
31. How many times the nyquist rate do you want the sampling frequency to be? (2 - 4, 11): 2
32.
33. THE CARRIER FREQUENCY (IN HERTZ, F7.2): (NOT USED FOR NOW)
34. DO YOU WANT THE COMPRESSOR/EXPANDER IN? Y-YES , N-NO : N
35.
36. DO YOU WANT THE PRE-EMPHASIS - DE-EMPHASIS FILTERS IN ? Y-YES , N-NO : N
37.
38. DO YOU WANT A CO-CHANNEL INTERFERER IN THE UPLINK? Y-YES,N-NO: N
39.
40. IS FADING PRESENT IN THE UPLINK CHANNEL? Y-YES,N-NO: N
41. DO YOU WANT A CO-CHANNEL INTERFERER IN THE DOWNLINK? Y-YES,N-NO: Y
42.
43. Are multiple values of the carrier to interference power
44. ratio to be tested? (Y/N): Y
45.
46. Input the range of values to be tested (in DB):
47. Input the initial value (-99 -- +99,13) : 60DB
48.
49. Input the increment value (01 -- 99,13) : 10DB
50.
51. Input the final value (01 -- 99,13) : 60DB
52.
53. Are multiple values of the interference phase values
54. to be tested? (Y/N): Y
55.
56. Input the range of values to be tested (in degrees):
57. Input the initial value (F6.2) : 10.00DEGREES
58.
59.

2

60. Input the increment value (F6.2) : 5.00DEGREES
61. Input the final value (F6.2) : 10.00DEGREES
62. IS FADING PRESENT IN THE DOWNLINK CHANNEL? Y-YES,N-NO: Y
63. IS A SPACE DIVERSITY RECEIVER BEING USED? Y-YES,N-NO: Y
64. IS THE INTERFERENCE FADED? Y-YES,N-NO: Y
65. THE DOWNLINK FADING CHANNEL IS PRESENT
66. SET PARAMETERS FOR FIRST FADING CHANNEL:
67. TYPES OF FADING CHANNELS AVAILABLE:
68. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
69. 2: SPECULAR COMPONENT, SHORTEST PATH
70. 3: SPECULAR COMPONENT, MEAN PATH
71. INPUT TYPE OF CHANNEL: 2
72. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
73. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
74. Are multiple values of the specular to multipath power
75. ratio to be tested? (Y/N): Y
76. Input the range of values to be tested (in dB):
77. Input the initial value (-99 -- +99,I3): 55DB
78. Input the increment value (-99 -- +99,I2): 10DB
79. Input the final value (01 -- 99,I2): 55DB
80. SET PARAMETERS FOR THE SECOND FADING CHANNEL:
81. TYPES OF FADING CHANNELS AVAILABLE:
82. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
83. 2: SPECULAR COMPONENT, SHORTEST PATH
84. 3: SPECULAR COMPONENT, MEAN PATH
85. INPUT TYPE OF CHANNEL: 2
86. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
87. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
88. Are multiple values of the specular to multipath power
89. ratio to be tested? (Y/N): Y
90. Input the range of values to be tested (in dB):
91. Input the initial value (-99 -- +99,I3): 55DB
92. Input the increment value (-99 -- +99,I2): 10DB
93. Input the final value (01 -- 99,I2): 55DB
94. SET PARAMETERS FOR THE THIRD FADING CHANNEL:
95. TYPES OF FADING CHANNELS AVAILABLE:
96. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
97. 2: SPECULAR COMPONENT, SHORTEST PATH
98. 3: SPECULAR COMPONENT, MEAN PATH
99. INPUT TYPE OF CHANNEL: 2
100. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
101. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
102. Are multiple values of the specular to multipath power
103. ratio to be tested? (Y/N): Y
104. Input the range of values to be tested (in dB):
105. Input the initial value (-99 -- +99,I3): 55DB
106. Input the increment value (-99 -- +99,I2): 10DB
107. Input the final value (01 -- 99,I2): 55DB
108. Are multiple SNR values to be tested? Y-yes,N-no: Y
109. Input the range of SNR values to be tested (in Db):
110. Input the initial value of SNR (-99 -- +99, I3): 36 DB
111. Input the increment value (01 -- 99, I2): 4 DB
112. 119.

ORIGINAL PAGE IS
OF POOR QUALITY

3

120. Input value ending value of SNR (-99 -- +99, 13): 40 DB
 121. IS A SPACE LIVEPSTY RECEIVER REQUIRED? (Y/N) Y
 122. INPUT DURATION BETWEEN DECISION TIMES FOR THE S.D. RECEIVER (F7.5, IN SECONDS) 0.000205EC.
 123. Input the approximate duration of simulation in seconds (0.01 - 9.59, F4.2): 0.01 SEC.

Type of performance measurement available:

1. Compare recovered output signal to original input signal
2. Measure output signal to noise ratio

Input type:

1

DO YOU WANT OUTPUT TO BE PLOTTED? Y

- 1-Rectangular to multipath power ratio- Downlink Channel
- 2-Carrier to interference power ratios- UHF Downlink Channel
- 3-Phase values of interference- UHF Downlink Channel
- 4-Input SNR value

1

2

3

4

Input signal	Output signal (No Noise)	Output signal (With Noise)
0.00000000 01	-0.3546265E 03	0.9127492E 02
0.00000000 02	-0.1308870E 04	0.3434618E 03
0.00000000 03	-0.2297429E 04	0.6371396E 03
0.00000000 04	-0.2868278E 04	0.9103672E 03
0.00000000 05	-0.2998826E 04	0.1288146E 04
0.00000000 06	-0.2613447E 04	0.1859902E 04
0.00000000 07	-0.1618976E 04	0.2839659E 04
0.00000000 08	0.4053446E 02	0.4315348E 04
0.00000000 09	0.2359897E 04	0.6330977E 04
0.00000000 10	0.5289641E 04	0.8833236E 04
0.00000000 11	0.8754653E 04	0.1193763E 05
0.00000000 12	0.1265577E 05	0.1501877E 05
0.00000000 13	0.1626928E 05	0.1921204E 05
0.00000000 14	0.2125363E 05	0.2318742E 05
0.00000000 15	0.2565789E 05	0.2726433E 05
0.00000000 16	0.2992698E 05	0.3111771E 05
0.00000000 17	0.3390676E 05	0.3478900E 05
0.00000000 18	0.3745015E 05	0.3807883E 05
0.00000000 19	0.4042305E 05	0.4084572E 05
0.00000000 20	0.4270941E 05	0.4235873E 05
0.00000000 21	0.4421438E 05	0.4313964E 05
0.00000000 22	0.4496550E 05	0.4366210E 05
0.00000000 23	0.4461211E 05	0.4453346E 05
0.00000000 24	0.4342422E 05	0.4329643E 05
0.00000000 25	0.4129246E 05	0.4113549E 05
0.00000000 26	0.3823110E 05	0.3805855E 05
0.00000000 27	0.3428400E 05	0.3410566E 05
0.00000000 28	0.2952932E 05	0.2935406E 05
0.00000000 29	0.2407629E 05	0.2391016E 05
0.00000000 30	0.1805300E 05	0.1789995E 05
0.00000000 31	0.1159213E 05	0.1145747E 05
0.00000000 32	0.0822430E 04	0.0713137E 04
0.00000000 33	-0.2134279E 04	-0.2213715E 04
0.00000000 34	-0.3164680E 04	-0.3219867E 04
0.00000000 35	-0.1616573E 05	-0.1621178E 05
0.00000000 36	-0.2304516E 05	-0.2309281E 05

ORIGINAL PAGE IS
OF POOR QUALITY

4

190.	-0.8090329E 00	-0.2972033E 05	-0.2976236E 05
191.	-0.7431634E 00	-0.3611538E 05	-0.3613345E 05
192.	-0.6691524E 00	-0.4215837E 05	-0.4215495E 05
193.	-0.5878101E 00	-0.4777842E 05	-0.4777386E 05
194.	-0.5000271E 00	-0.5290458E 05	-0.5290686E 05
195.	-0.4067667E 00	-0.5746700E 05	-0.5748503E 05
196.	-0.3090497E 00	-0.6139990E 05	-0.6144706E 05
197.	-0.2079459E 00	-0.6464539E 05	-0.6471502E 05
198.	-0.1045648E 00	-0.6715650E 05	-0.6722169E 05
199.	-0.3718153E-04	-0.6809931E 05	-0.6833938E 05
200.	0.1044899E 00	-0.6985300E 05	-0.6986744E 05
201.	0.2078722E 00	-0.7000956E 05	-0.7000250E 05
202.	0.3089781E 00	-0.6937213E 05	-0.6934825E 05
203.	0.4066978E 00	-0.6795288E 05	-0.6792225E 05
204.	0.4999627E 00	-0.6577056E 05	-0.6574175E 05
205.	0.5677492E 00	-0.6284800E 05	-0.6282023E 05
206.	0.6630964E 00	-0.5920971E 05	-0.5918269E 05
207.	0.7431136E 00	-0.5488154E 05	-0.5486558E 05
208.	0.8098886E 00	-0.4989328E 05	-0.4989481E 05
209.	0.8660005E 00	-0.4429588E 05	-0.4429971E 05
210.	0.9135250E 00	-0.3812075E 05	-0.3813838E 05
211.	0.9510405E 00	-0.3149445E 05	-0.3150355E 05
212.	0.9701367E 00	-0.2448261E 05	-0.2451255E 05
213.	0.9945163E 00	-0.1722654E 05	-0.1727591E 05
214.	0.1066000E 01	-0.9822348E 04	-0.9866230E 04
215.	0.9945278E 00	-0.2367284E 04	-0.2432360E 04
216.	0.9791597E 00	0.5050090E 04	0.4999566E 04
217.	0.9510749E 00	0.1235017E 05	0.1232246E 05
218.	0.9135698E 00	0.1945291E 05	0.1946250E 05
219.	0.8660561E 00	0.2632707E 05	0.2635513E 05
220.	0.8090535E 00	0.3288803E 05	0.3292590E 05
221.	0.7431874E 00	0.3909482E 05	0.3913027E 05
222.	0.6691790E 00	0.4489691E 05	0.4493780E 05
223.	0.5878384E 00	0.5024172E 05	0.5028242E 05
224.	0.5000582E 00	0.5507376E 05	0.5509581E 05
225.	0.4067986E 00	0.5933614E 05	0.5933974E 05
226.	0.3090830E 00	0.6297383E 05	0.6297384E 05
227.	0.2079611E 00	0.6593744E 05	0.6593544E 05
228.	0.1045996E 00	0.6818643E 05	0.6817588E 05
229.	0.7309525E-04	0.6969169E 05	0.6968163E 05
230.	-0.1044542E 00	0.7043463E 05	0.7043706E 05
231.	-0.2078381E 00	0.7040856E 05	0.7041113E 05
232.	-0.3099439E 00	0.6961644E 05	0.6960206E 05
233.	-0.4066659E 00	0.6806944E 05	0.6804369E 05
234.	-0.4999316E 00	0.6578450E 05	0.6576169E 05
235.	-0.5977201E 00	0.6278211E 05	0.6276499E 05
236.	-0.6690704E 00	0.5908429E 05	0.5906898E 05
237.	-0.7430896E 00	0.5471427E 05	0.5470021E 05
238.	-0.8089681E 00	0.4969926E 05	0.4968748E 05
239.	-0.8659830E 00	0.4407779E 05	0.4406672E 05
240.	-0.9135104E 00	0.3790904E 05	0.3789540E 05
241.	-0.9510297E 00	0.3127739E 05	0.3126080E 05
242.	-0.9781293E 00	0.2428645E 05	0.2427244E 05
243.	-0.9945125E 00	0.1704566E 05	0.1704160E 05
244.	-0.1000000E 01	0.9659547E 04	0.9667125E 04
245.	-0.9945316E 00	0.2224056E 04	0.2236339E 04
246.	-0.9781669E 00	-0.5173293E 04	-0.5167508E 04
247.	-0.9510357E 00	-0.1245371E 05	-0.1246022E 05
248.	-0.9135844E 00	-0.1954774E 05	-0.1956504E 05
249.	-0.8660736E 00	-0.2639459E 05	-0.2641453E 05

ORIGINAL PAGE IS
OF POOR QUALITY

6

-0.3252382E 05
-0.3873486E 05
-0.4455445E 05
-0.4991791E 05
-0.5477025E 05
-0.5905626E 05
-0.6271593E 05
-0.6570694E 05
-0.6800881E 05
-0.6958081E 05
-0.7038119E 05
-0.7040781E 05
-0.6967275E 05
-0.6818431E 05
-0.6595363E 05
-0.6299994E 05
-0.5935133E 05
-0.5503618E 05
-0.5008200E 05
-0.4452383E 05
-0.3841241E 05
-0.3191904E 05
-0.2484891E 05
-0.1761683E 05
-0.1023401E 05

-0.3250146E 05
-0.3871931E 05
-0.4453807E 05
-0.4990534E 05
-0.5476577E 05
-0.5906239E 05
-0.6273980E 05
-0.6574794E 05
-0.6804550E 05
-0.6960200E 05
-0.7039825E 05
-0.7042663E 05
-0.6968919E 05
-0.6819650E 05
-0.6596506E 05
-0.6301504E 05
-0.5936834E 05
-0.5504795E 05
-0.5008057E 05
-0.4450350E 05
-0.3837407E 05
-0.3177484E 05
-0.2480832E 05
-0.1758397E 05
-0.1020682E 05

-0.8134920E 00
-0.7482617E 00
-0.6748396E 00
-0.5940157E 00
-0.5065984E 00
-0.4138190E 00
-0.3184213E 00
-0.2155436E 00
-0.1123206E 00
-0.7452316E-02
0.9688678E-01
0.2001823E 00
0.3014705E 00
0.3994715E 00
0.4930838E 00
0.5813091E 00
0.6631559E 00
0.737512E 00
0.8042567E 00
0.8619632E 00
0.9102221E 00
0.9485188E 00
0.9764227E 00
0.9936365E 00
0.999966E 00

=====
* INPUT SIGNAL, += OUTPUT-NO NOISE, *= FADED OUTPUT
* : 1-SPACE= 0.181818E-01
* : 1-SPACE= 0.128063E 04
* : 1-SPACE= 0.128119E 04
=====

720.
721.
722.
723.
724.
725.
726.
727.
728.
729.
730.
731.
732.
733.
734.
735.
736.
737.
738.
739.
740.
741.
742.
743.
744.
745.
746.
747.
748.
749.
750.
751.
752.
753.
754.
755.
756.
757.
758.
759.
760.
761.
762.
763.
764.
765.
766.
767.
768.
769.
770.
771.
772.
773.
774.
775.
776.
777.
778.
779.

ORIGINAL PAGE IS
OF POOR QUALITY

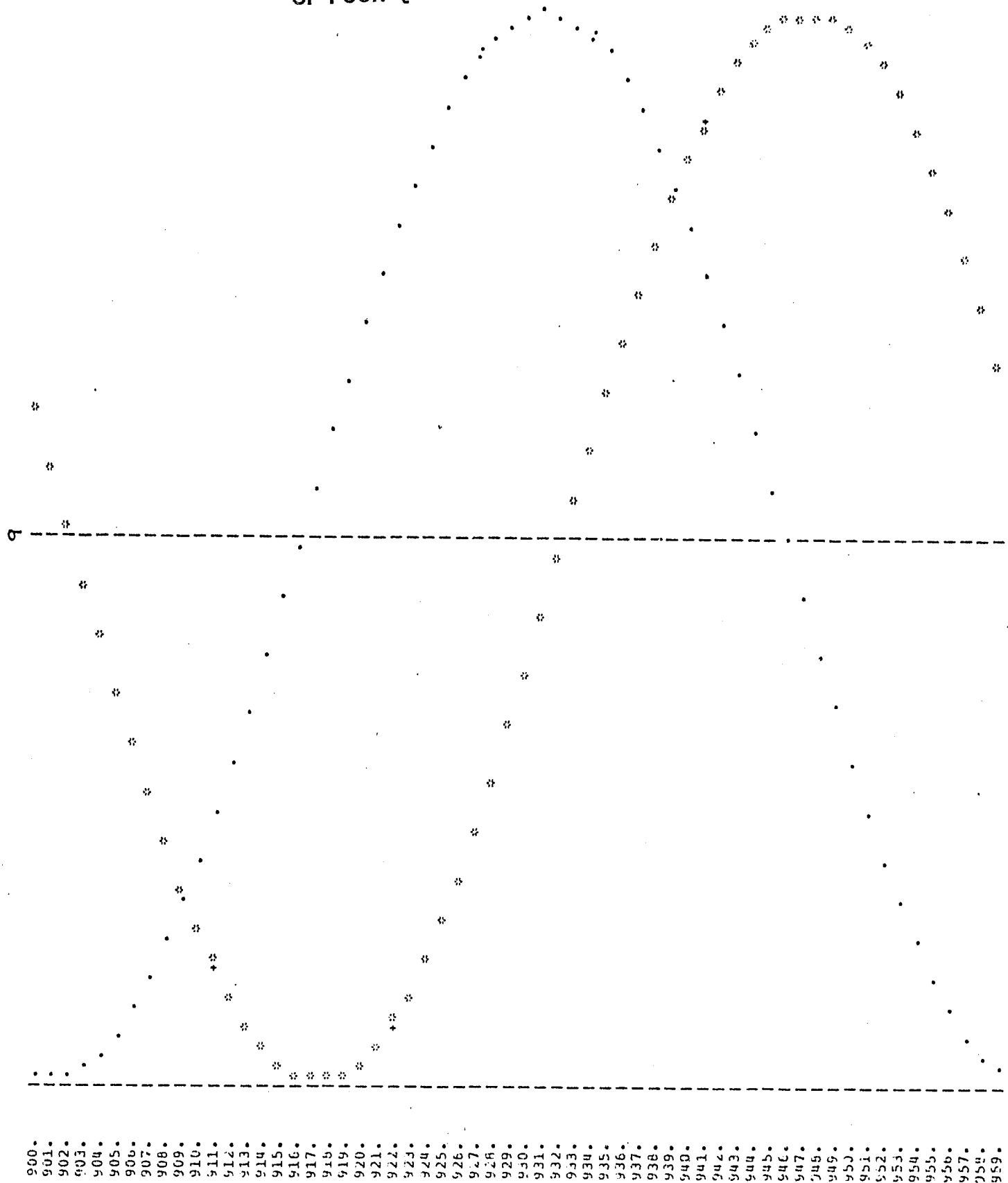
780
781
782.
783.
784.
785.
786.
787.
788.
789.
790.
791.
792.
793.
794.
795.
796.
797.
798.
799.
800.
801.
802.
803.
804.
805.
806.
807.
808.
809.
810.
811.
812.
813.
814.
815.
816.
817.
818.
819.
820.
821.
822.
823.
824.
825.
826.
827.
828.
829.
830.
831.
832.
833.
834.
835.
836.
837.
838.
839.

ORIGINAL PAGE IS
OF POOR QUALITY

∞ - - - - -

640.
641.
642.
643.
644.
645.
646.
647.
648.
649.
650.
651.
652.
653.
654.
655.
656.
657.
658.
659.
660.
661.
662.
663.
664.
665.
666.
667.
668.
669.
670.
671.
672.
673.
674.
675.
676.
677.
678.
679.
680.
681.
682.
683.
684.
685.
686.
687.
688.
689.
690.
691.
692.
693.
694.
695.
696.
697.
698.
699.

ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY

	10			
	1	2	3	4
1320.	0.1000000E 01	0.1000000E 01	0.2772237E 04	0.2795974E 04
1321.	0.9945219E 00	0.9945219E 00	0.4938637E 04	0.4803941E 04
1322.	0.9781477E 00	0.9781477E 00	0.1286013E 05	0.1282084E 05
1323.	0.9510567E 00	0.9510567E 00	0.2100998E 05	0.2098013E 05
1324.	0.9135456E 00	0.9135456E 00	0.2873141E 05	0.2873206E 05
1325.	0.8660256E 00	0.8660256E 00	0.3586253E 05	0.3588194E 05
1326.	0.8090173E 00	0.8090173E 00	0.4242826E 05	0.4245813E 05
1327.	0.7431453E 00	0.7431453E 00	0.4839245E 05	0.4841986E 05
1328.	0.6691312E 00	0.6691312E 00	0.5374292E 05	0.5376315E 05
1329.	0.5877859E 00	0.5877859E 00	0.5848212E 05	0.5849372E 05
1330.	0.5000010E 00	0.5000010E 00	0.6259657E 05	0.6260185E 05
1331.	0.4067382E 00	0.4067382E 00	0.6605913E 05	0.6607675E 05
1332.	0.3390183E 00	0.3390183E 00	0.6888213E 05	0.6889513E 05
1333.	0.2079136E 00	0.2079136E 00	0.7101725E 05	0.7103463E 05
1334.	0.1045300E 00	0.1045300E 00	0.7245975E 05	0.7248288E 05
1335.	0.2221441E-05	0.2221441E-05	0.7320056E 05	0.7322319E 05
1336.	-0.1045247E 00	-0.1045247E 00	0.7323656E 05	0.7324936E 05
1337.	-0.2079074E 00	-0.2079074E 00	0.7257094E 05	0.7257475E 05
1338.	-0.3090113E 00	-0.3090113E 00	0.7121225E 05	0.7121025E 05
1339.	-0.4067307E 00	-0.4067307E 00	0.6917375E 05	0.6916425E 05
1340.	-0.4999930E 00	-0.4999930E 00	0.6647131E 05	0.6645313E 05
1341.	-0.5877774E 00	-0.5877774E 00	0.6312226E 05	0.6309744E 05
1342.				
1343.				
1344.				
1345.				
1346.				
1347.				
1348.				
1349.				
1350.				
1351.				
1352.				
1353.				
1354.				
1355.				
1356.				
1357.				
1358.				
1359.				
1360.				
1361.				
1362.				
1363.				
1364.				
1365.				
1366.				
1367.				
1368.				
1369.				
1370.				
1371.				
1372.				
1373.				
1374.				
1375.				
1376.				
1377.				
1378.				
1379.				

ORIGINAL PAGE 03
OF POOR QUALITY

11

0.5934452E 05
0.5501455E 05
0.5003273E 05
0.4444214E 05
0.3830386E 05
0.3170295E 05
0.2474108E 05
0.1752593E 05
0.1015360E 05
0.2720426E 04
-0.4675144E 04
-0.1194940E 05
-0.1904743E 05
-0.2591674E 05
-0.3246980E 05
-0.3870435E 05
-0.4451641E 05
-0.4980629E 05
-0.5475410E 05
-0.5905006E 05
-0.6272255E 05
-0.6573019E 05
-0.6803163E 05
-0.6959408E 05
-0.7039825E 05
-0.7043138E 05
-0.6969200E 05
-0.6819775E 05
-0.6597188E 05
-0.6302990E 05
-0.5938573E 05
-0.5506212E 05
-0.5008956E 05
-0.4450699E 05
-0.3837339E 05
-0.3177151E 05
-0.2480193E 05
-0.1757286E 05
-0.1019132E 05

0.59344346E 05
0.5501693E 05
0.5004760E 05
0.4446686E 05
0.3833419E 05
0.3173232E 05
0.2476386E 05
0.1753824E 05
0.1016046E 05
0.2727003E 04
-0.4674066E 04
-0.1196336E 05
-0.1907083E 05
-0.2593518E 05
-0.3250172E 05
-0.3871952E 05
-0.4453823E 05
-0.4993544E 05
-0.5476582E 05
-0.5906240E 05
-0.6273977E 05
-0.6574788E 05
-0.6804544E 05
-0.6960189E 05
-0.7039819E 05
-0.7042656E 05
-0.6968913E 05
-0.6819644E 05
-0.6596494E 05
-0.6301495E 05
-0.5935823E 05
-0.5504783E 05
-0.5008954E 05
-0.4450338E 05
-0.3837396E 05
-0.3177475E 05
-0.2480826E 05
-0.1758392E 05
-0.1020677E 05

-0.6636401E 00
-0.7301890E 00
-0.8046411E 00
-0.8622911E 00
-0.9104099E 00
-0.9437236E 00
-0.9756233E 00
-0.9937092E 00
-0.9999716E 00
-0.9952628E 00
-0.9796954E 00
-0.9533756E 00
-0.9166194E 00
-0.8698184E 00
-0.8134990E 00
-0.7442617E 00
-0.6748396E 00
-0.5940157E 00
-0.5066944E 00
-0.4138190E 00
-0.3164213E 00
-0.2155439E 00
-0.1123206E 00
-0.7052316E-02
0.9668678E-01
0.2001823E 00
0.3014705E 00
0.3994715E 00
0.4730638E 00
0.5413091E 00
0.6631559E 00
0.7377512E 00
0.8042567E 00
0.9619632E 00
0.9102221E 00
0.9445186E 00
0.9764227E 00
0.9936365E 00
0.9999666E 00

1920.
1921.
1922.
1923.
1924.
1925.
1926.
1927.
1928.
1929.
1930.
1931.
1932.
1933.
1934.
1935.
1936.
1937.
1939.
1939.
1939.
1940.
1941.
1942.
1943.
1944.
1945.
1946.
1947.
1948.
1949.
1950.
1951.
1952.
1953.
1954.
1955.
1956.
1957.
1958.
1959.
1960.
1961.
1962.
1963.
1964.
1965.
1966.
1967.
1968.
1969.
1970.
1971.
1972.
1973.
1974.
1975.
1976.
1977.
1978.
1979.

=====

==INPUT SIGNAL,==OUTPUT-NO NOISE,==FADFD OUTPUT

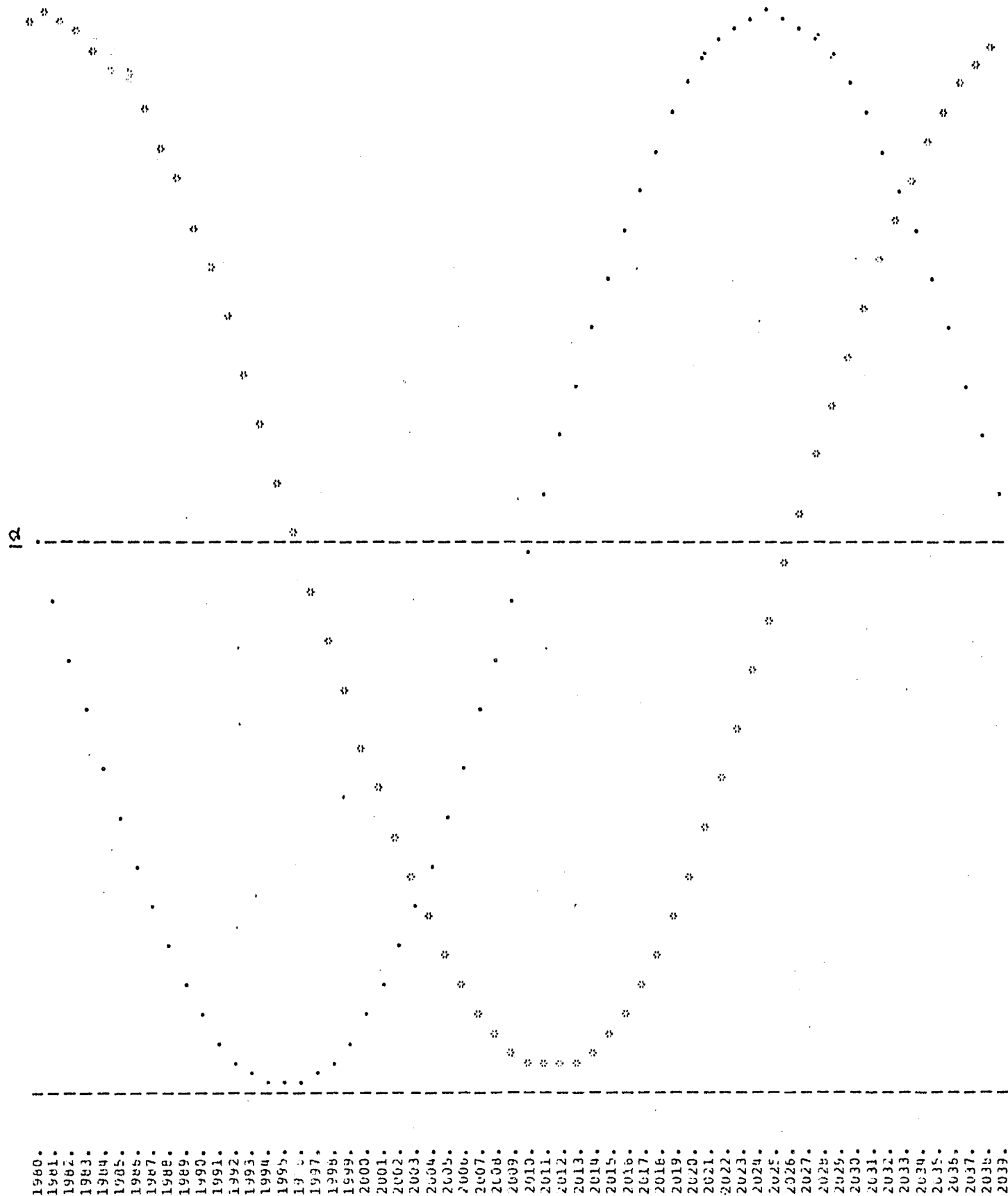
.. 1-SPACE= 0.101818E-01

.. 1-SPACE= 0.133157E 04

.. 1-SPACE= 0.133161E 04

=====

ORIGINAL PART 10 OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY

1. SIGTP=1
2
3. Is this an online session? (Y/N) N
4.
5. TYPE OF CALL AVAILABLE:
6. 1: M1->M2, rural mobile to rural mobile in same UHF beam
7. 2: M1->M3, rural mobile to rural mobile in different UHF beam, in same S-band
8. 3: M1->M4, rural mobile to rural mobile in different UHF beam, in different S-band
9. 4: M1->FC1, rural mobile to fixed in same S-band beam
10. 5: M1->FC2, rural mobile to fixed in different S-band beam
11. 6: FC1->M1, fixed to rural mobile in same S-band beam
12. 7: FC2->M1, fixed to rural mobile in different S-band beam
13. INPUT TYPE OF CALL TO BE SIMULATED: 1
14.
15. MODE OF CALL AVAILABLE:
16. 1: M1->M2, hard wired transponder
17. 2: M1->M2, direct switched transponder
18. 3: M1->M2, indirect switched transponder
19. 4: M1->G1->M2, double hop system
20. INPUT MODE OF CALL TO BE SIMULATED: 1
21.
22. FREQUENCY OF THE BASEBAND SIGNAL (LESS THAN 3000 HZ.) (IN HERTZ, F7.2): 1000.00 HZ
23.
24. NOTE : POWER OF THE BASEBAND SIGNAL HAS TO BE LESS OR EQUAL THAN .5 WATTS:
25. SO THAT THE MAXIMUM INSTANTANEOUS FREQUENCY DEVIATION IS
26. LESS OR EQUAL THAN 12000 HZ
27. POWER OF THE BASEBAND SIGNAL(IN WATTS, F7.2): 0.50 WATTS
28.
29. THE CARRIER POWER (IN WATTS, F7.2): 1.00 WATTS
30.
31. THE FREQUENCY DEVIATION (IN HERTZ, F8.2): 12000 HZ. (FIXED FOR NOW)
32. How many times the nvaust rate do you want the sampling frequency to be? (2 - 4, I1): 2
33.
34. THE CARRIER FREQUENCY (IN HERTZ, F7.2):(NOT USED FOR NOW)
35. DO YOU WANT THE COMPRESSOR/EXPANDER IN? Y-YES , N-NO : Y
36.
37. DO YOU WANT THE PRE-EMPHASIS - DE-EMPHASIS FILTERS IN ? Y-YES , N-NO : Y
38.
39. DO YOU WANT A CO-CHANNEL INTERFERER IN THE UPLINK? Y-YES,N-NO: Y
40.
41. Are multiple values of the carrier to interference power
42. ratio to be tested? (Y/N) : Y
43.
44. Input the range of values to be tested (in DB):
45. Input the initial value (-99 -- +99,I3) : 30DB
46.
47. Input the increment value (01 -- 99,I3) : 10DB
48.
49. Input the final value (01 -- 99,I3) : 40DB
50.
51. Are multiple values of the interference phase values
52. to be tested? (Y/N) : Y
53.
54. Input the range of values to be tested (in dearees):
55. Input the initial value (F6.2) : 5.00 DEGREES
56.
57. Input the increment value (F6.2) : 1.00 DEGREES
58.
59. Input the final value (F6.2) :

ORIGINAL PAGE 19
OF POOR QUALITY

2

60. IS FADING PRESENT IN THE UPLINK CHANNEL? Y-YES,N-NO: Y
61. 6.00 DEGREES
62. CHANNEL? Y-YES,N-NO: Y
63. IS THE INTERFERENCE FADED? Y-YES,N-NO: Y
64. THE UPLINK FADING CHANNEL IS PRESENT
65. TYPES OF FADING CHANNELS AVAILABLE:
66. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
67. 2: SPECULAR COMPONENT, SHORTEST PATH
68. 3: SPECULAR COMPONENT, MEAN PATH
69. INPUT TYPE OF CHANNEL:
70. 2
71. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
72. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
73. Are multiple values of the specular to multipath power
74. ratio to be tested? (Y/N): Y
75. Input the range of values to be tested (in DB):
76. Input the initial value (-99 -- +99,I3): 50DB
77. Input the increment value (-99 -- +99,I2): 10DB
78. Input the final value (01 -- 99,I2): 60DB
79. DO YOU WANT A CO-CHANNEL INTERFERER IN THE DOWNLINK? Y-YES,N-NO: Y
80. Are multiple values of the carrier to interference power
81. ratio to be tested? (Y/N): Y
82. Input the range of values to be tested (in DB):
83. Input the initial value (-99 -- +99,I3): 10DB
84. Input the increment value (01 -- 99,I3): 20DB
85. Input the final value (01 -- 99,I3): 20DB
86. Are multiple values of the interference phase values
87. to be tested? (Y/N): Y
88. Input the range of values to be tested (in degrees):
89. Input the initial value (F6.2): 10.00DEGREES
90. Input the increment value (F6.2): 5.00DEGREES
91. Input the final value (F6.2): 15.00DEGREES
92. IS FADING PRESENT IN THE DOWNLINK CHANNEL? Y-YES,N-NO: Y
93. IS A SPACE DIVERSITY RECEIVER BEING USED? Y-YES,N-NO: Y
94. IS THE INTERFERENCE FADED? Y-YES,N-NO: Y
95. THE DOWNLINK FADING CHANNEL IS PRESENT
96. SET PARAMETERS FOR FIRST FADING CHANNEL:
97. TYPES OF FADING CHANNELS AVAILABLE:
98. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
99. 2: SPECULAR COMPONENT, SHORTEST PATH
100. 3: SPECULAR COMPONENT, MEAN PATH
101. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
102. 2: SPECULAR COMPONENT, SHORTEST PATH
103. 3: SPECULAR COMPONENT, MEAN PATH
104. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
105. 2: SPECULAR COMPONENT, SHORTEST PATH
106. 3: SPECULAR COMPONENT, MEAN PATH
107. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
108. 2: SPECULAR COMPONENT, SHORTEST PATH
109. 3: SPECULAR COMPONENT, MEAN PATH
110. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
111. 2: SPECULAR COMPONENT, SHORTEST PATH
112. 3: SPECULAR COMPONENT, MEAN PATH
113. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
114. 2: SPECULAR COMPONENT, SHORTEST PATH
115. 3: SPECULAR COMPONENT, MEAN PATH
116. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
117. 2: SPECULAR COMPONENT, SHORTEST PATH
118. 3: SPECULAR COMPONENT, MEAN PATH
119. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
120. 2: SPECULAR COMPONENT, SHORTEST PATH
121. 3: SPECULAR COMPONENT, MEAN PATH

ORIGINAL PAGE IS
OF POOR QUALITY

3

120. INPUT TYPE OF CHANNEL: 2
121. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
122. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
123. Are multiple values of the specular to multipath power ratio to be tested? (Y/N): Y
124. Input the range of values to be tested (in dB):
125. Input the initial value (-99 -- +99, I3): 11DB
126. Input the increment value (-99 -- +99, I2): 10DB
127. Input the final value (01 -- 99, I2): 23DB
128. SET PARAMETERS FOR THE SECOND FADING CHANNEL:
129. TYPES OF FADING CHANNELS AVAILABLE:
130. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
131. 2: SPECULAR COMPONENT (SHORTEST PATH)
132. 3: SPECULAR COMPONENT, MEAN PATH
133. INPUT TYPE OF CHANNEL: 2
134. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
135. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
136. Are multiple values of the specular to multipath power ratio to be tested? (Y/N): Y
137. Input the range of values to be tested (in dB):
138. Input the initial value (-99 -- +99, I3): 11DB
139. Input the increment value (-99 -- +99, I2): 10DB
140. Input the final value (01 -- 99, I2): 23DB
141. Are multiple SNR values to be tested? Y-ves, N-no: Y
142. Input the range of SNR values to be tested (in Db):
143. Input the initial value of SNR (-99 -- +99, I3): 10 DB
144. Input the increment value (01 -- 99, I2): 40 DB
145. Input the ending value of SNR (-99 -- +99, I3): 40 DB
146. IS A SPACE DIVERSITY RECEIVER REQUIRED? (Y/N) Y
147. INPUT DURATION BETWEEN DECISION TIMES FOR THE S.D. RECEIVER (F7.5, IN SECONDS) 0.00020SEC.
148. Input the approximate duration of simulation in seconds (0.01 - 9.99, F4.2): 0.01 SEC.
149. Type of performance measurement available:
150. 1. Compare recovered output signal to original input signal
151. 2. Measure output signal to noise ratio
152. Input type: 2
153. 1- Specular to multipath power ratio- Uplink Channel.
154. 2-Specular to multipath power ratio- Downlink Channel
155. 3-Carrier to interference power ratios- UHF Uplink Channel
156. 170.
157. 171.
158. 172.
159. 173.
160. 174.
161. 175.
162. 176.
163. 177.
164. 178.
165. 179.

ORIGINAL PAGE IN
OF POOR QUALITY

4-Phase values of interference- UHF UplinkChannel
5-Carrier to interference power ratios- UHF Downlink Channel
6-Phase values of interference- UHF Downlink Channel
7-Input SNR Value
8-Output SNR Value

	1	2	3	4	5	6	7	8
180.	50.00	11.00	30.00	5.00	10.00	10.00	10.00000000	30.3934021
181.	50.00	11.00	30.00	5.00	10.00	10.00	14.00000000	47.3245239
182.	50.00	11.00	30.00	5.00	10.00	10.00	18.00000000	50.2981110
183.	50.00	11.00	30.00	5.00	10.00	10.00	22.00000000	51.2792206
184.	50.00	11.00	30.00	5.00	10.00	10.00	26.00000000	54.7541809
185.	50.00	11.00	30.00	5.00	10.00	10.00	30.00000000	52.6393585
186.	50.00	11.00	30.00	5.00	10.00	10.00	34.00000000	56.1096954
187.	50.00	11.00	30.00	5.00	10.00	10.00	38.00000000	56.5043640
188.	50.00	11.00	30.00	5.00	10.00	15.00	10.00000000	44.7787476
189.	50.00	11.00	30.00	5.00	10.00	15.00	14.00000000	48.3026123
190.	50.00	11.00	30.00	5.00	10.00	15.00	18.00000000	49.7561340
191.	50.00	11.00	30.00	5.00	10.00	15.00	22.00000000	50.7426758
192.	50.00	11.00	30.00	5.00	10.00	15.00	26.00000000	56.9706879
193.	50.00	11.00	30.00	5.00	10.00	15.00	30.00000000	56.2624512
194.	50.00	11.00	30.00	5.00	10.00	15.00	34.00000000	56.3646682
195.	50.00	11.00	30.00	5.00	10.00	15.00	38.00000000	53.2024231
196.	50.00	11.00	30.00	5.00	10.00	15.00	10.00000000	43.4536896
197.	50.00	11.00	30.00	5.00	20.00	10.00	10.00000000	45.6832581
198.	50.00	11.00	30.00	5.00	20.00	10.00	14.00000000	49.5190517
199.	50.00	11.00	30.00	5.00	20.00	10.00	18.00000000	51.9888763
200.	50.00	11.00	30.00	5.00	20.00	10.00	22.00000000	52.6079559
201.	50.00	11.00	30.00	5.00	20.00	10.00	26.00000000	54.6950989
202.	50.00	11.00	30.00	5.00	20.00	10.00	30.00000000	53.6224518
203.	50.00	11.00	30.00	5.00	20.00	10.00	34.00000000	56.5738373
204.	50.00	11.00	30.00	5.00	20.00	10.00	38.00000000	44.2585754
205.	50.00	11.00	30.00	5.00	20.00	15.00	10.00000000	47.7853851
206.	50.00	11.00	30.00	5.00	20.00	15.00	14.00000000	50.1994781
207.	50.00	11.00	30.00	5.00	20.00	15.00	18.00000000	51.76335803
208.	50.00	11.00	30.00	5.00	20.00	15.00	22.00000000	55.5586243
209.	50.00	11.00	30.00	5.00	20.00	15.00	26.00000000	53.9149475
210.	50.00	11.00	30.00	5.00	20.00	15.00	30.00000000	57.5394592
211.	50.00	11.00	30.00	5.00	20.00	15.00	34.00000000	54.8444366
212.	50.00	11.00	30.00	5.00	20.00	10.00	10.00000000	45.7154999
213.	50.00	11.00	30.00	5.00	20.00	10.00	14.00000000	47.1175690
214.	50.00	11.00	30.00	5.00	20.00	10.00	18.00000000	50.5426788
215.	50.00	11.00	30.00	5.00	20.00	10.00	22.00000000	51.5821686
216.	50.00	11.00	30.00	5.00	20.00	10.00	26.00000000	55.7178497
217.	50.00	11.00	30.00	5.00	20.00	10.00	30.00000000	51.3821564
218.	50.00	11.00	30.00	5.00	20.00	10.00	34.00000000	53.1560211
219.	50.00	11.00	30.00	5.00	20.00	10.00	38.00000000	53.6389618
220.	50.00	11.00	30.00	5.00	20.00	15.00	10.00000000	45.3472900
221.	50.00	11.00	30.00	5.00	20.00	15.00	14.00000000	48.1585999
222.	50.00	11.00	30.00	5.00	20.00	15.00	18.00000000	49.5726776
223.	50.00	11.00	30.00	5.00	20.00	15.00	22.00000000	52.5881348
224.	50.00	11.00	30.00	5.00	20.00	15.00	26.00000000	52.2198944
225.	50.00	11.00	30.00	5.00	20.00	15.00	30.00000000	54.8355865
226.	50.00	11.00	30.00	5.00	20.00	15.00	34.00000000	58.1746674
227.	50.00	11.00	30.00	5.00	20.00	15.00	38.00000000	55.4336243
228.	50.00	11.00	30.00	5.00	20.00	10.00	10.00000000	43.6742096
229.	50.00	11.00	30.00	5.00	20.00	10.00	14.00000000	46.3095856
230.	50.00	11.00	30.00	5.00	20.00	10.00	18.00000000	48.9533997
231.	50.00	11.00	30.00	5.00	20.00	10.00	22.00000000	49.1971588
232.	50.00	11.00	30.00	5.00	20.00	10.00	26.00000000	54.4777325
233.	50.00	11.00	30.00	5.00	20.00	10.00	30.00000000	
234.	50.00	11.00	30.00	5.00	20.00	10.00	34.00000000	
235.	50.00	11.00	30.00	5.00	20.00	10.00	38.00000000	
236.	50.00	11.00	30.00	5.00	20.00	10.00	10.00000000	
237.	50.00	11.00	30.00	5.00	20.00	10.00	14.00000000	
238.	50.00	11.00	30.00	5.00	20.00	10.00	18.00000000	
239.	50.00	11.00	30.00	5.00	20.00	10.00	22.00000000	
	50.00	11.00	30.00	5.00	20.00	10.00	26.00000000	

ORIGINAL FILED
OF POOR QUALITY

5

240.	50.00	11.00	30.00	6.00	20.00	10.00	30.00000000	51.7566528
241.	50.00	11.00	30.00	6.00	20.00	10.00	34.00000000	56.4712982
242.	50.00	11.00	30.00	6.00	20.00	10.00	38.00000000	58.8856659
243.	50.00	11.00	30.00	6.00	20.00	15.00	10.00000000	43.9559326
244.	50.00	11.00	30.00	6.00	20.00	15.00	14.00000000	46.8102417
245.	50.00	11.00	30.00	6.00	20.00	15.00	18.00000000	50.4780731
246.	50.00	11.00	30.00	6.00	20.00	15.00	22.00000000	52.0825348
247.	50.00	11.00	30.00	6.00	20.00	15.00	26.00000000	48.2390594
248.	50.00	11.00	30.00	6.00	20.00	15.00	30.00000000	49.6101379
249.	50.00	11.00	30.00	6.00	20.00	15.00	34.00000000	58.3103750
250.	50.00	11.00	30.00	6.00	20.00	15.00	38.00000000	56.8903198
251.	50.00	11.00	40.00	5.00	10.00	10.00	10.00000000	44.8637543
252.	50.00	11.00	40.00	5.00	10.00	10.00	14.00000000	47.4381714
253.	50.00	11.00	40.00	5.00	10.00	10.00	18.00000000	49.4681702
254.	50.00	11.00	40.00	5.00	10.00	10.00	22.00000000	51.1010895
255.	50.00	11.00	40.00	5.00	10.00	10.00	26.00000000	52.2202301
256.	50.00	11.00	40.00	5.00	10.00	10.00	30.00000000	53.9355164
257.	50.00	11.00	40.00	5.00	10.00	10.00	34.00000000	52.8522644
258.	50.00	11.00	40.00	5.00	10.00	10.00	38.00000000	55.8222351
259.	50.00	11.00	40.00	5.00	10.00	15.00	10.00000000	44.6431580
260.	50.00	11.00	40.00	5.00	10.00	15.00	14.00000000	47.5508575
261.	50.00	11.00	40.00	5.00	10.00	15.00	18.00000000	50.2478333
262.	50.00	11.00	40.00	5.00	10.00	15.00	22.00000000	52.2345428
263.	50.00	11.00	40.00	5.00	10.00	15.00	26.00000000	55.0059662
264.	50.00	11.00	40.00	5.00	10.00	15.00	30.00000000	56.0988922
265.	50.00	11.00	40.00	5.00	10.00	15.00	34.00000000	56.1244202
266.	50.00	11.00	40.00	5.00	10.00	15.00	38.00000000	53.4188232
267.	50.00	11.00	40.00	5.00	20.00	10.00	10.00000000	44.6074371
268.	50.00	11.00	40.00	5.00	20.00	10.00	14.00000000	49.0097961
269.	50.00	11.00	40.00	5.00	20.00	10.00	18.00000000	47.6365051
270.	50.00	11.00	40.00	5.00	20.00	10.00	22.00000000	52.2730255
271.	50.00	11.00	40.00	5.00	20.00	10.00	26.00000000	53.8841705
272.	50.00	11.00	40.00	5.00	20.00	10.00	30.00000000	53.2715454
273.	50.00	11.00	40.00	5.00	20.00	10.00	34.00000000	57.8299561
274.	50.00	11.00	40.00	5.00	20.00	10.00	38.00000000	54.3217926
275.	50.00	11.00	40.00	5.00	20.00	15.00	10.00000000	44.5611572
276.	50.00	11.00	40.00	5.00	20.00	15.00	14.00000000	47.4875946
277.	50.00	11.00	40.00	5.00	20.00	15.00	18.00000000	52.7612762
278.	50.00	11.00	40.00	5.00	20.00	15.00	22.00000000	52.9886627
279.	50.00	11.00	40.00	5.00	20.00	15.00	26.00000000	54.1265869
280.	50.00	11.00	40.00	5.00	20.00	15.00	30.00000000	55.7081604
281.								

CITY UNIVERSITY / UNIVERSITY COMPUTER CENTER

1. Is this an online session? (Y/N) N

2. TYPE OF CALL AVAILABLE:

3. 1: M1->M2, rural mobile to rural mobile in same UHF beam

4. 2: M1->M3, rural mobile to rural mobile in different UHF beam, in same S-band

5. 3: M1->M4, rural mobile to rural mobile in different UHF beam, in different S-band

6. 4: M1->FC1, rural mobile to fixed in same S-band beam

7. 5: M1->FC2, rural mobile to fixed in different S-band beam

8. 6: FC1->M1, fixed to rural mobile in same S-band beam

9. 7: FC2->M1, fixed to rural mobile in different S-band beam

10. INPUT TYPE OF CALL TO BE SIMULATED: 1

11. MODE OF CALL AVAILABLE:

12. 1: M1->M2, hard wired transponder

13. 2: M1->M2, direct switched transponder

14. 3: M1->M2, indirect switched transponder

15. 4: M1->G1->M2, double hop system

16. INPUT MODE OF CALL TO BE SIMULATED: 2

17. TYPE OF SIGNAL SOURCES AVAILABLE:

18. 1: Program generated single tone sinusoid.

19. 2: Sampled voice from tape source.

20. Choose type of signal to be used (I1) : 1

21. FREQUENCY OF THE BASEBAND SIGNAL (LESS THAN 3000 HZ.) (IN HERTZ, F7.2): 1000.00 HZ

22. NOTE : POWER OF THE BASEBAND SIGNAL HAS TO BE LESS OR EQUAL THAN .5 WATTS;
SO THAT THE MAXIMUM INSTANTANEOUS FREQUENCY DEVIATION IS
LESS OR EQUAL THAN 12000 HZ

23. POWER OF THE BASEBAND SIGNAL(IN WATTS, F7.2): 0.50 WATTS

24. THE CARRIER POWER (IN WATTS, F7.2): 1.00 WATTS

25. THE FREQUENCY DEVIATION (IN HERTZ, F8.2): 12000 HZ. (FIXED FOR NOW)

26. How many times the nyquist rate do you want the sampling frequency to be? (2 - 4, I1): 2

27. THE CARRIER FREQUENCY (IN HERTZ, F7.2):(NOT USED FOR NOW)

28. DO YOU WANT THE COMPRESSOR/EXPANDER IN? Y-YES , N-NO : Y

29. DO YOU WANT THE PRE-EMPHASIS - DE-EMPHASIS FILTERS IN ? Y-YES , N-NO : N

30. DO YOU WANT A CO-CHANNEL INTERFERER IN THE UPLINK? Y-YES,N-NO: Y

31. Are multiple values of the carrier to interference power
ratio to be tested? (Y/N): Y

32. Input the range of values to be tested (in DB):

33. Input the initial value (-99 -- +99,I3) : 0DB

34. Input the increment value (01 -- 99,I3) : 4DB

35. Input the final value (01 -- 99,I3) : 20DB

36. Are multiple values of the interference phase values
to be tested? (Y/N): N

37. INPUT PHASE OF INTERFERENCE IN DEGREES (F7.2): 0.0 DEGREES

38. IS FADING PRESENT IN THE UHF - UPLINK CHANNEL? Y-YES,N-NO:

•

2.0000000	4.0946465
6.0000000	8.0117111
10.0000000	12.7808000
14.0000000	19.5500641
18.0000000	32.6866150
22.0000000	32.9690552
26.0000000	33.1688690
30.0000000	33.2720642
34.0000000	33.2924957
38.0000000	33.3184357

60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43

✿
✿
✿
✿
✿
✿



180.	42	181.	41	182.	40	183.	39	184.	38	185.	37	186.	36	187.	35	188.	34	189.	33	190.	32	191.	31	192.	30	193.	29	194.	28	195.	27	196.	26	197.	25	198.	24	199.	23	200.	22	201.	21	202.	20	203.	19	204.	18	205.	17	206.	16	207.	15	208.	14	209.	13	210.	12	211.	11	212.	10	213.	9	214.	8	215.	7	216.	6	217.	5	218.	4	219.	3	220.	2	221.	1	222.	0	223.	-1	224.	-2	225.	-3	226.	-4	227.	-5	228.	-6	229.	-7	230.	-8	231.	-9	232.	-8	233.	-8	234.	-8	235.	-8	236.	-8	237.	-8	238.	-8	239.	-8
------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	---	------	---	------	---	------	---	------	---	------	---	------	---	------	---	------	---	------	---	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----

2.0000000	5.5844812
6.0000000	12.5382137
10.0000000	20.1515198
14.0000000	35.6455841
18.0000000	38.2522888
22.0000000	40.1487885
26.0000000	40.9440308
30.0000000	41.2815399

ORIGINAL PAGE IS
OF POOR QUALITY

[illegible]

12.00	2.0000000	5.8544693
12.00	6.0006000	13.1358242
12.00	10.0000000	26.9282990
12.00	14.0000000	36.7619019
12.00	18.0000000	40.3987885
12.00	22.0000000	43.8037872
12.00	26.0000000	46.4313202
12.00	30.0000000	48.0451660
12.00	34.0000000	49.0501404
12.00	38.0000000	49.4731903

[illegible]

60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 |

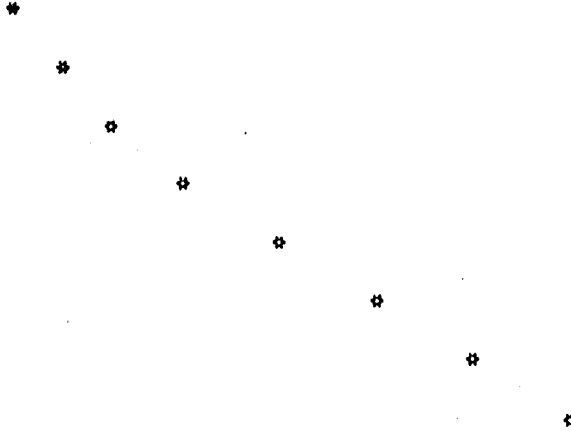
ORIGINAL PAGE IS
OF POOR QUALITY

360.	291
361.	271
362.	261
363.	251
364.	241
365.	231
366.	221
367.	211
368.	201
369.	191
370.	181
371.	171
372.	161
373.	151
374.	141
375.	131
376.	121
377.	111
378.	101
379.	91
380.	81
381.	71
382.	61
383.	51
384.	41
385.	31
386.	21
387.	11
388.	01
389.	-11
390.	-21
391.	-31
392.	-41
393.	-51
394.	-61
395.	-71
396.	-81
397.	-91
398.	16.000
399.	16.000
400.	16.000
401.	16.000
402.	16.000
403.	16.000
404.	16.000
405.	16.000
406.	16.000
407.	16.000
408.	DB16
409.	101
410.	111
411.	851
412.	841
413.	831
414.	821
415.	811
416.	801
417.	791
418.	781
419.	771

[illegible]

85
84
83
82
81
80
79
78
77

ORIGINAL 176
OF POOR QUALITY



420.
421.
422.
423.
424.
425.
426.
427.
428.
429.
430.
431.
432.
433.
434.
435.
436.
437.
438.
439.
440.
441.
442.
443.
444.
445.
446.
447.
448.
449.
450.
451.
452.
453.
454.
455.
456.
457.
458.
459.
460.
461.
462.
463.
464.
465.
466.
467.
468.
469.
470.
471.
472.
473.
474.
475.
476.
477.
478.
479.

761
751
741
731
721
711
701
691
681
671
661
651
641
631
621
611
601
591
581
571
561
551
541
531
521
511
501
491
481
471
461
451
441
431
421
411
401
391
381
371
361
351
341
331
321
311
301
291
281
271
261
251
241
231
221
211
201
191
181
171

481.
482.
483.
484.
485.
486.
487.
488.
489.
490.
491.
492.
493.
494.
495.
496.
497.
498.
499.
500.
501.
502.
503.
504.
505.
506.
507.
508.
509.
510.
511.
512.
513.
514.
515.
516.
517.
518.
519.
520.
521.
522.
523.
524.
525.
526.
527.
528.
529.
530.
531.
532.
533.
534.
535.
536.
537.
538.
539.

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

2.0000000	5.4610615
6.0000000	13.1388855
10.0000000	27.0707397
14.0000000	37.2620392
18.0000000	41.1725922
22.0000000	45.0943604
26.0000000	49.0807800
30.0000000	53.0763855
34.0000000	56.6542053
38.0000000	59.9796906

[illegible]

85 | 84 | 83 | 82 | 81 | 80 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 |

ORIGINAL PAGE IS
OF POOR QUALITY

540.
541.
542.
543.
544.
545.
546.
547.
548.
549.
550.
551.
552.
553.
554.
555.
556.
557.
558.
559.
560.
561.
562.
563.
564.
565.
566.
567.
568.
569.
570.
571.
572.
573.
574.
575.
576.
577.
578.
579.
580.
581.
582.
583.
584.
585.
586.
587.
588.
589.
590.
591.
592.
593.
594.
595.
596.
597.
598.
599.

64.
63.
62.
61.
60.
59.
58.
57.
56.
55.
54.
53.
52.
51.
50.
49.
48.
47.
46.
45.
44.
43.
42.
41.
40.
39.
38.
37.
36.
35.
34.
33.
32.
31.
30.
29.
28.
27.
26.
25.
24.
23.
22.
21.
20.
19.
18.
17.
16.
15.
14.
13.
12.
11.
10.
9.
8.
7.
6.
5.

1. Is this an online session? (Y/N) N

2. TYPE OF CALL AVAILABLE:

3. 1: M1->M2, rural mobile to rural mobile in same UHF beam

4. 2: M1->M3, rural mobile to rural mobile in different UHF beam, in same S-band

5. 3: M1->M4, rural mobile to rural mobile in different UHF beam, in different S-band

6. 4: M1->FC1, rural mobile to fixed in same S-band beam

7. 5: M1->FC2, rural mobile to fixed in different S-band beam

8. 6: FC1->M1, fixed to rural mobile in same S-band beam

9. 7: FC2->M1, fixed to rural mobile in different S-band beam

10. INPUT TYPE OF CALL TO BE SIMULATED: 1

11. MODE OF CALL AVAILABLE:

12. 1: M1->M2, hard wired transponder

13. 2: M1->M2, direct switched transponder

14. 3: M1->M2, indirect switched transponder

15. 4: M1->M1->M2, double hop system

16. INPUT MODE OF CALL TO BE SIMULATED: 4

17. TYPE OF SIGNAL SOURCES AVAILABLE:

18. 1: Program generated single tone sinusoid.

19. 2: Sampled voice from tape source.

20. Choose type of signal to be used (I1) : 1

21. FREQUENCY OF THE BASEBAND SIGNAL (LESS THAN 3000 HZ.) (IN HERTZ, F7.2): 1000.00 HZ

22. NOTE : POWER OF THE BASEBAND SIGNAL HAS TO BE LESS OR EQUAL THAN .5 WATTS;
SO THAT THE MAXIMUM INSTANTANEOUS FREQUENCY DEVIATION IS
LESS OR EQUAL THAN 12000 HZ

23. POWER OF THE BASEBAND SIGNAL(IN WATTS, F7.2): 0.50 WATTS

24. THE CARRIER POWER (IN WATTS, F7.2): 1.00 WATTS

25. THE FREQUENCY DEVIATION (IN HERTZ, F8.2): 12000 HZ. (FIXED FOR NOW)

26. How many times the nyquist rate do you want the sampling frequency to be? (2 - 4, I1): 2

27. THE CARRIER FREQUENCY (IN HERTZ, F7.2): (NOT USED FOR NOW)

28. DO YOU WANT THE COMPRESSOR/EXPANDER IN? Y-YES, N-NO : Y

29. DO YOU WANT THE PRE-EMPHASIS - DE-EMPHASIS FILTERS IN? Y-YES, N-NO : N

30. DO YOU WANT A CO-CHANNEL INTERFERER IN THE UPLINK? Y-YES, N-NO: N

31. IS FADING PRESENT IN THE UHF - UPLINK CHANNEL? Y-YES, N-NO: Y

32. IS THE INTERFERENCE FADED? Y-YES, N-NO: N

33. THE UPLINK FADING CHANNEL IS PRESENT

34. TYPES OF FADING CHANNELS AVAILABLE:

35. 1: NO SPECULAR COMPONENT (RALEIGH FADING)

36. 2: SPECULAR COMPONENT, SHORTEST PATH

37. 3: SPECULAR COMPONENT, MEAN PATH

38. INPUT TYPE OF CHANNEL: 2

39. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS

40. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ

41. Are multiple values of the specular to multipath power

ORIGINAL PAGE IS
OF POOR QUALITY

60. ratio to be tested: (Y/N): Y
61. Input the range of values to be tested (in DB):
62. Input the initial value (-99 -- +99,I3): 10DB
63.
64. Input the increment value (-99 -- +99,I2): 25DB
65.
66. Input the final value (01 -- 99,I2): 90DB
67.
68. DO YOU WANT A CO-CHANNEL INTERFERER IN THE S-BAND DOWNLINK ? Y-YES,N-NO: N
69.
70. IS FADING PRESENT IN THE S-BAND DOWNLINK CHANNEL? Y-YES,N-NO: Y
71.
72. IS A SPACE DIVERSITY RECEIVER BEING USED? Y-YES,N-NO: N
73.
74. THE DOWNLINK FADING CHANNEL IS PRESENT
75. SET PARAMETERS FOR FADING CHANNEL.
76. TYPES OF FADING CHANNELS AVAILABLE:
77. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
78. 2: SPECULAR COMPONENT, SHORTEST PATH
79. 3: SPECULAR COMPONENT, MEAN PATH
80. INPUT TYPE OF CHANNEL:
81. 2
82. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
83.
84. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
85.
86. Are multiple values of the specular to multipath power
87. ratio to be tested? (Y/N): Y
88.
89. Input the range of values to be tested (in DB):
90. Input the initial value (-99 -- +99,I3): 11DB
91.
92. Input the increment value (-99 -- +99,I2): 25DB
93.
94. Input the final value (01 -- 99,I2): 90DB
95.
96. DO YOU WANT A CO-CHANNEL INTERFERER IN THE S-BAND UPLINK? Y-YES,N-NO: N
97.
98. IS FADING PRESENT IN THE S-BAND UPLINK CHANNEL? Y-YES,N-NO: Y
99.
100. IS THE INTERFERENCE FADED? Y-YES,N-NO: N
101.
102. THE UPLINK FADING CHANNEL IS PRESENT
103. TYPES OF FADING CHANNELS AVAILABLE:
104. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
105. 2: SPECULAR COMPONENT, SHORTEST PATH
106. 3: SPECULAR COMPONENT, MEAN PATH
107. INPUT TYPE OF CHANNEL:
108. 2
109. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
110.
111. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
112.
113. Are multiple values of the specular to multipath power
114. ratio to be tested? (Y/N): Y
115.
116. Input the range of values to be tested (in DB):
117. Input the initial value (-99 -- +99,I3): 12DB
118.
119.

120. Input the increment value (-99 -- +99, I2): 25DB
 121. Input the final value (01 -- 99, I2): 90DB
 122. DO YOU WANT A CO-CHANNEL INTERFERER IN THE DOWNLINK? Y-YES, N-NO: N
 123. IS FADING PRESENT IN THE UHF - DOWNLINK CHANNEL? Y-YES, N-NO: Y
 124. IS A SPACE DIVERSITY RECEIVER BEING USED? Y-YES, N-NO: N
 125. THE DOWNLINK FADING CHANNEL IS PRESENT
 126. SET PARAMETERS FOR FADING CHANNEL.
 127. TYPES OF FADING CHANNELS AVAILABLE:
 128. 1: NO SPECULAR COMPONENT (RALEIGH FADING)
 129. 2: SPECULAR COMPONENT, SHORTEST PATH
 130. 3: SPECULAR COMPONENT, MEAN PATH
 131. INPUT TYPE OF CHANNEL: 2
 132. ENTER THE MULTIPATH SPREAD TIME (IN MICROSECONDS, F9.2): 500.00 MICROSECONDS
 133. ENTER THE DOPPLER SPREAD BANDWIDTH (IN HERTZ, F7.2): 1.00 HZ
 134. Are multiple values of the specular to multipath power
 135. ratio to be tested? (Y/N): Y
 136. Input the range of values to be tested (in DB):
 137. Input the initial value (-99 -- +99, I3): 14DB
 138. Input the increment value (-99 -- +99, I2): 25DB
 139. Input the final value (01 -- 99, I2): 90DB
 140. Are multiple SNR values to be tested? Y-yes, N-no: Y
 141. Input the range of SNR values to be tested (in Db):
 142. Input the initial value of SNR (-99 -- +99, I3): 1 DB
 143. Input the increment value (01 -- 99, I2): 5 DB
 144. Input the ending value of SNR (-99 -- +99, I3): 40 DB
 145. IS A SPACE DIVERSITY RECEIVER REQUIRED? (Y/N) N
 146. Input the approximate duration of simulation in seconds (0.01 - 9.99, F5.2): 0.02 SEC.
 147. Type of performance measurement available:
 148. 1. Compare recovered output signal to original input signal
 149. 2. Measure output signal to noise ratio
 150. Input type: 2
 151. Do you want output to be plotted? (Y/N): N
 152. 1- Specular to multipath power ratio- UHF Uplink Channel.
 153. 2- Specular to multipath power ratio- S-BAND Downlink Channel.
 154. 3- Specular to multipath power ratio- S-BAND Uplink Channel.
 155. 4- Specular to multipath power ratio- UHF Downlink Channel.
 156. 5- Input SNR Value
 157. 6- Output SNR Value
 158. 1 2 3 4 5 6
 159. 170.
 160. 171.
 161. 172.
 162. 173.
 163. 174.
 164. 175.
 165. 176.
 166. 177.
 167. 178.
 168. 179.

END
DATE

JUN 27 1983

ORIGINAL PAGE IS
OF POOR QUALITY

180.	10.00	11.00	12.00	14.00	1.00000000	31.8197632
181.	10.00	11.00	12.00	14.00	6.00000000	34.6829987
182.	10.00	11.00	12.00	14.00	11.00000000	38.5540161
183.	10.00	11.00	12.00	14.00	16.00000000	40.3591614
184.	10.00	11.00	12.00	14.00	21.00000000	36.0269775
185.	10.00	11.00	12.00	14.00	26.00000000	40.2135925
186.	10.00	11.00	12.00	14.00	31.00000000	41.0075531
187.	10.00	11.00	12.00	14.00	36.00000000	41.8792419
188.	10.00	11.00	12.00	14.00	1.00000000	32.0381775
189.	10.00	11.00	37.00	14.00	6.00000000	38.1804352
190.	10.00	11.00	37.00	14.00	11.00000000	37.1580200
191.	10.00	11.00	37.00	14.00	16.00000000	42.1793671
192.	10.00	11.00	37.00	14.00	21.00000000	43.2643585
193.	10.00	11.00	37.00	14.00	26.00000000	46.9673157
194.	10.00	11.00	37.00	14.00	31.00000000	48.9451447
195.	10.00	11.00	37.00	14.00	36.00000000	42.9842072
196.	10.00	11.00	37.00	14.00	1.00000000	33.0088196
197.	10.00	11.00	62.00	14.00	6.00000000	37.2350464
198.	10.00	11.00	62.00	14.00	11.00000000	41.5312103
199.	10.00	11.00	62.00	14.00	16.00000000	42.7033081
200.	10.00	11.00	62.00	14.00	21.00000000	39.6892242
201.	10.00	11.00	62.00	14.00	26.00000000	39.7191010
202.	10.00	11.00	62.00	14.00	31.00000000	44.9123077
203.	10.00	11.00	62.00	14.00	36.00000000	39.7561920
204.	10.00	11.00	62.00	14.00	1.00000000	20.8714905
205.	10.00	11.00	87.00	14.00	6.00000000	36.3123120
206.	10.00	11.00	87.00	14.00	11.00000000	40.2752686
207.	10.00	11.00	87.00	14.00	16.00000000	42.8176880
208.	10.00	11.00	87.00	14.00	21.00000000	40.7845306
209.	10.00	11.00	87.00	14.00	26.00000000	45.0499725
210.	10.00	11.00	87.00	14.00	31.00000000	40.1223450
211.	10.00	11.00	87.00	14.00	36.00000000	45.1003876
212.	10.00	11.00	87.00	14.00	1.00000000	32.4762726
213.	10.00	36.00	12.00	14.00	6.00000000	34.8208313
214.	10.00	36.00	12.00	14.00	11.00000000	37.4087982
215.	10.00	36.00	12.00	14.00	16.00000000	42.6144714
216.	10.00	36.00	12.00	14.00	21.00000000	38.4624634
217.	10.00	36.00	12.00	14.00	26.00000000	43.3883820
218.	10.00	36.00	12.00	14.00	31.00000000	40.4772797
219.	10.00	36.00	12.00	14.00	36.00000000	43.5606537
220.	10.00	36.00	12.00	14.00	1.00000000	33.0967865
221.	10.00	36.00	37.00	14.00	6.00000000	37.3872528
222.	10.00	36.00	37.00	14.00	11.00000000	38.3372498
223.	10.00	36.00	37.00	14.00	16.00000000	40.9699707
224.	10.00	36.00	37.00	14.00	21.00000000	43.6113129
225.	10.00	36.00	37.00	14.00	26.00000000	45.5793457
226.	10.00	36.00	37.00	14.00	31.00000000	44.8579315
227.	10.00	36.00	37.00	14.00	36.00000000	43.0029449
228.	10.00	36.00	37.00	14.00	1.00000000	31.4471283
229.	10.00	36.00	62.00	14.00	6.00000000	35.7543030
230.	10.00	36.00	62.00	14.00	11.00000000	41.5781708
231.	10.00	36.00	62.00	14.00	16.00000000	43.9695587
232.	10.00	36.00	62.00	14.00	21.00000000	41.0463257
233.	10.00	36.00	62.00	14.00	26.00000000	43.2192688
234.	10.00	36.00	62.00	14.00	31.00000000	41.2209320
235.	10.00	36.00	62.00	14.00	36.00000000	42.5592041
236.	10.00	36.00	62.00	14.00	1.00000000	31.7581329
237.	10.00	36.00	87.00	14.00	6.00000000	36.1853180
238.	10.00	36.00	87.00	14.00	11.00000000	40.9545441
239.	10.00	36.00	87.00	14.00		